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REPORT

OF THE

PENNSYLVANIA

DEPARTMENT OF FORESTRY,

FOR THE YEAR 1907.

HARRISBURG, PA.:
HARRISBURG PUBLISHING CO., STATE PRINTER.
1908.

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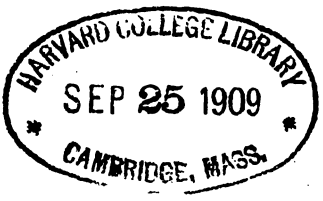

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PLATE I. First Class Graduated from the State Forest Academy, 1906.
Ralph E. Brock, Lewis E. Staley, William L. Byers, Robert G. Conklin,
William H. Kraft, John E. Avery.

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PLATE V. "The Forest Primeval." Patterson's Run, Pennypacker Reserve, Perry County.

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property from taxation section 2 provides that "all laws exempting property from taxation other than the property above enumerated shall be void."

The provisions of the act allowing a rebate of eighty per centum in certain cases therein described, destroys uniformity of taxation in that it only applies to tracts of fifty acres and under; and so far as its effects are concerned, it offends against uniformity of taxation unless eighty per centum of the taxes assessed against the lands within the legislative description amount to exactly forty-five cents per acre. Adjoining owners may each own fifty acres within the legislative description, one tract assessed at thirty dollars an acre and the other at seventy-five dollars an acre. If the rebate on the tract assessed at thirty dollars amounts to just forty-five cents per acre, he will be entitled to the rebate. If it amounted to less than forty-five cents per acre he would not get a rebate of forty-five cents. If the eighty per centum rebate on the tract assessed at seventy-five dollars amounted to more than forty-five cents per acre he would not get the eighty per centum rebate. This law then would apply so far as the amount of the rebate per acre is concerned only to cases where the rebate would amount to exactly forty-five cents.

To Illustrate: "A" owned thirty-five acres of land within the legislative description assessed at thirty dollars per acre; the total tax levy is twenty-six mills on the dollar. The taxes on one acre assessed at thirty dollars multiplied by the twenty-six millage rate equals seventy-eight cents; of this seventy-eight cents the act provides that "A" is entitled to eighty per centum rebate, provided said eighty per centum does not exceed on all taxes levied the sum of forty-five cents per acre; now eighty per centum of seventy-eight cents equals sixty-two cents and sixty-two cents is seventeen cents in excess of forty-five cents—the maximum limit fixed by the act.

On account of the rate of assessment combined with the millage rate of taxation on "A's" acre of land, we find that seventeen cents of his taxes cannot be allowed under the eighty per centum rebate provision because eighty per centum of seventy-eight is seventeen cents in excess of forty-five cents, the maximum limit. "A" then instead of being allowed eighty per centum rebate on his acre of land is allowed fifty-seven per centum rebate.

Take another illustration: "B" owns land within the legislative description with the same tax levy of twenty-six mills, which is assessed at nineteen dollars per acre. One acre assessed at nineteen dollars multiplied by twenty-six, the millage, equals forty-nine cents —the total taxes per acre on "B's" land. Eighty per centum of forty-nine cents equals thirty-nine cents, the amount of rebate to which "B" is entitled on every acre. As thirty-nine cents, the

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amount of rebate to which "B" is entitled, does not exceed the maximum limit of forty-five cents per acre, "B" is then entitled to the whole of his eighty per centum rebate.

"C" owns one hundred and fifty acres within the legislative description, with a twenty-six mill tax levy assessed at thirty dollars an acre. As in the case of "A," "C" is entitled to fifty-seven per centum rebate on fifty acres of one hundred and fifty acres amounting to forty-five cents per acre, and on the remaining one hundred acres "C" pays one hundred per centum of the taxes of seventy-eight cents per acre. We thus have three distinct taxes on forested lands owned by "A," "B," and "C." "B" pays twenty per centum of the twenty-six mill tax levy; "A" pays forty-three per centum of the twenty-six mill tax levy and "C" pays forty-three per centum of the twenty-six mill tax levy on fifty acres of his one hundred and fifty acres and pays one hundred per centum on the remaining one hundred acres.

Take another illustration: "A" owns fifty acres of land within the legislative description upon which he pays twenty per centum of the taxes levied, he being entitled to the eighty per centum rebate; "B" owns one thousand acres of land within the legislative description. "B" pays twenty per centum of the taxes levied upon fifty acres and one hundred per centum of the taxes levied upon nine hundred and fifty acres.

Thus we see "A" is entitled to a rebate of eighty per centum on all taxes levied on his lands of a certain kind, whereas "B" is entitled to a rebate in the aggregate of four per centum from the taxes levied on all of his lands of the same kind.

When considered in connection with existing laws, the act is impossible of practicable application.

We wish to call attention to the fact that the provisions of the act in question relating to the rebate apply to all taxes levied.

This must include special cash taxes which may be levied by the court of quarter sessions upon any township of the county at any time during the year. This being the case, the county commissioners who are charged with the preparation of the tax duplicates for the collectors of taxes, and who are also charged with the notations thereon of the amount of rebate to be allowed any taxable claiming the same upon timber lands, cannot perform those duties without possible violation of the act in depriving certain persons entitled thereto to their proportion of the rebate, if the commissioners make up the tax duplicates any time before December 31 in each year. To delay thus in putting out the duplicates would be manifestly impracticable as the county and other tax levying districts would be deprived of necessary funds for carrying on the machin-

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ery of government. And such a course would also be in flat violation of the provision of law requiring the duplicates to reach the hands of the collectors not later than August 1 in each year. If the duplicates are delivered to the collectors the first day of August each year, this leaves five months of the year in which special taxes may be levied upon which no rebate could be allowed, as there is no authority in the collector to allow any rebate under the provisions of the act in question. Indeed the collector has no means of knowing, from the face of his duplicate, who are and who are not entitled to such rebate, as the assessor and county commissioners are the only officials having any knowledge of any claim for rebate under the act being considered.

The county tax is levied early in January, the local tax early in March, the school tax any time during the month of June, after the first Monday, special cash tax any time during the year. A deduction of five per centum for prompt payment is allowed on local taxes from the date of their levy to June 1; the face of the tax is payable from June 1 to November 1, five per centum being added after November 1. A similar deduction is allowed on county taxes for payment within sixty days of the advertisement by the collector. The face of the tax may be paid during the four months following the sixty days and five per centum is added after the expiration of four months.

The amount of tax depending on the time of payment, the county commissioners cannot know what amount of rebate on any individual tax should be noted on the duplicate.

Any attempt to apply the act leads to inextricable confusion.

For all these reasons we are constrained to the conclusion that the act is unconstitutional and cannot lawfully be enforced.

THE NEW FIRE WARDEN LAW.

By act approved April 25, 1907, the Fire Warden law was amended in accordance with the recommendations of the Department and from experience gained in enforcing the old laws of March 30, 1897, and March 31, 1905. The act was recast in its entirely, and many new features added. Under the old law constables only were ex-officio fire wardens, while under the new, constables and the employes of this Department are ex-officio fire wardens. Fire wardens may now enter adjacent boroughs, counties and townships, which they could not do formerly, they may appoint deputies not exceeding

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five, and their pay is more certain under the new act than under the old. The new law further provides that all persons who assist in extinguishing fires shall be paid for their services, and provides a method by which the amount of services is ascertained. The revised act is as follows:

AN ACT

Making constables of boroughs and townships, and their deputies, and the employes of the Department of Forestry ex officio fire-wardens, for the extinguishment of forest or wild land fires; prescribing the duties of such fire-wardens, and their punishment for failure to perform the same; empowering them to procure the assistance of others in the extinguishment of such fires, and providing for the compensation of the said wardens and their assistants, and making an appropriation therefor.

Fire-wardens.

Section 1. Be it enacted, &c., That all constables of boroughs and townships, and their deputies, and the

Constables, deputies et al.

employes of the Department of Forestry are hereby constituted ex officio fire-wardens, whose duty it shall

Power and duties.

be, when fire is discovered in or approaching forests or wild land, whether the same be owned by individuals, corporations or by the Commonwealth, immediately to take such measures as are necessary for its extinguishment; and who shall have, and are hereby given,

Authorized to employ assistance.

authority to employ such other persons as in their judgment may be necessary to render assistance in the extinguishing of such fires.

Section 2. The said fire-wardens, with the exception of the employes of the Department of Forestry, shall, while engaged in performing the duties imposed by

Compensation.

this act, receive twenty-five cents per hour, and the persons so employed to assist such wardens shall receive twenty cents per hour, as compensation for their services.

Section 3. All such fire-wardens shall render to the commissioners of the respective counties, within two

Warden's statement.

months from the date of any fire, an itemized statement under oath or affirmation, giving the location of the fire, the names of the persons engaged, the number of hours each was employed, the amount of expense incurred in the extinguishment of each fire, and, if possible, stating the origin of the fire; and the commissioners of the said counties, upon presentation thereof,

Payment.

shall immediately pay to the fire-warden, for the use of the persons so entitled, the respective amounts in full so ascertained to be due.

Section 4. At the end of each calendar year, after all fire bills shall have been received for the current

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year and settlements made by the county commissioners, the said commissioners shall furnish, under oath or affirmation, to the Auditor General of the Commonwealth a written, itemized statement of all such payments made; and the said Auditor General after the same is approved by him, shall draw his warrant upon the State Treasurer, in favor of the said county commissioners, for two-thirds of the total expense incurred by the said commissioners, in manner provided by this act, for the extinguishment of forest or wild land fires.

Commissioners' statement.

Warrants.

Section 5. The said ex-officio fire-wardens shall not be limited in their jurisdiction as fire-wardens to the townships, boroughs, and counties for which they were elected, or within which they may reside or are stationed; but shall have power and authority to enter adjacent or other townships, boroughs, or counties, and there to exercise the authority and perform the duties conferred and imposed by this act.

Jurisdiction of fire-wardens.

Powers.

Section 6. Whenever any such fire-warden or his assistants shall have rendered service in two or more counties, in extinguishing any fire which shall have burned in two or more counties, said warden shall render statements to the commissioners, respectively, of the counties wherein such service was rendered; setting forth the facts required to be stated by section three of this act, as accurately as may be, which said amounts, so ascertained to be due, shall be paid by the respective commissioners, in like manner as is provided by section three of this act.

Fires in two or more counties.

Payment for services.

Section 7. Constables of boroughs and townships are hereby empowered to appoint such deputies as are or may be necessary, not exceeding five in number, who shall be vested with the same authority as constables have under this act; and whenever any fire-warden, by reason of physical disability, unavoidable absence from home, or imperative necessity, shall be unable to perform the duties required by this act, said warden is hereby empowered to appoint a suitable person to act in his stead, who shall be paid twenty-five cents per hour for his services thus rendered, and who, when so appointed, shall be charged with all the duties and liabilities of said warden: Provided, That in making returns to the county commissioners, said returns

Deputy constables.

Disability of fire-wardens.

Substitute.

Proviso.

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shall be made by the warden upon report rendered under oath or affirmation, by the person so appointed.

Unauthorized services.

Section 8. Whenever, in the absence of a fire-warden, a forest or wild land fire shall be extinguished or combatted by persons without first having been employed by said warden, such persons shall receive the compensation provided by this act: Provided, That after a thorough investigation by the fire-warden, wherein he shall have power and authority to examine persons under oath or affirmation, he shall have ascertained, if possible, as a result of his investigation, the origin of the fire, the amount of services rendered by such persons, and that such service was necessary for the extinguishment of the fire, and shall certify the facts to the county commissioners, in like manner as hereinbefore provided.

Proviso.

Investigation.

Return, in case of death or disability.

Section 9. In case of the death of a fire-warden, before the making of any return to the county commissioners as provided for by this act, or in case of his total physical disability, said return may be made by another warden, after first ascertaining the facts; and in making such examination or investigation, said other warden is hereby empowered to examine persons under oath or affirmation.

Failure to perform duty.

False statement, etc.

Misdemeanor.

Fine and penalty.

Section 10. If any such ex officio fire-warden or other officer shall fail to perform his duty as set forth in section one of this act, or shall wilfully or negligently refuse to perform such duty, or shall render a false and fraudulent statement of services alleged to have been performed, under the provisions of this act, or shall fail or refuse to pay the respective amounts due those who have assisted him in extinguishing fires, after said amounts shall have been paid him by the county commissioners, such fire-wardens or other officer shall be deemed guilty of a misdemeanor, and, upon conviction thereof, shall be fined in a sum not exceeding one hundred dollars, or undergo imprisonment not exceeding three months, both or either, at the discretion of the court.

Appropriation.

Section 11. That the sum of forty thousand dollars, or so much thereof as may be necessary, be and the same is hereby specifically appropriated for the pay-

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PLATE VI. Primeval Forest, Swift Run, Snyder County.

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ment of the Commonwealth's share of the expense incurred under the provisions of this act.

Approved—The 25th day of April, A. D. 1907.

EDWIN S. STUART.

SHADE TREE COMMISSION.

Another statute somewhat collateral to the subject of forestry in general but having at least a relation to it, is the new Shade Tree Commission Act, whereby the planting and protection of shade trees in municipalities is given entirely into the care of an existing Park Commission or a Shade Tree Commission to be appointed, and to whose care all trees growing in the streets or by the roadside for shade purposes, shall be committed. An act somewhat similar has been in force for a time in the State of New Jersey, and has there given excellent results. The Shade Tree Commission of the city of Newark, N. J., and the results it has attained are models which may well be followed. The only drawback in the act is that it must first be adopted by the municipal authorities before it becomes operative in that municipality, so that with a prejudiced borough or city council, or in a community so constituted that it sees no value in shade trees, the act will confer few benefits or none at all. The act was approved by the Governor May 31, 1907, and is, in full, as follows:

AN ACT

To provide for the planting and care of shade-trees, on highways of townships of the first class, boroughs, and cities of the Commonwealth of Pennsylvania, and providing for the cost thereof.

Shade-trees.

Section 1. Be it enacted, &c., That in townships of the first class, boroughs, and cities of the Commonwealth of Pennsylvania there may be appointed, in the manner hereinafter provided, a Commission of three freeholders, to be known and designated as the Shade-tree Commission of the said township, borough, or city, who shall serve without compensation, and who shall have exclusive and absolute custody and control of, and power to plant, set out, remove, maintain, protect, and care for, shade-trees, on any of the public highways of the said townships, boroughs, and cities, the cost thereof to be provided for in the manner hereinafter stated: Provided, That in townships, boroughs,

Shade-tree Commission.

Proviso.

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or cities in which a Commission for the care of public parks shall have been created, said Commission shall, upon the acceptance of this act as provided in section two, be charged with the duties of the Commission as above provided, and shall, for that purpose, be possessed of all the powers herein mentioned and granted.

Existing park commissions.

Section 2. The commissioners of any township of the first class, or the councils of any borough or city, in the State of Pennsylvania, may, by majority vote in the case of the commissioners, or by joint resolution in the case of the councils, accept the provisions of this act; and when such majority vote or joint resolution shall have been duly passed and approved, and such Shade-tree Commissioners appointed, or, in their stead, the duties and powers herein provided have been devolved upon an existing park commission, then, from that time and in that event, this act and all its provisions shall be in full force and application in such township of the first class, borough, or city, so accepting; and such commissioners shall be appointed, for terms of three, four, and five years, respectively, and, on the expiration of any term, the new appointment shall be for five years, and any vacancies shall be filled for the unexpired term only; and in townships of the first class the said appointment shall be made by the commissioners thereof; and in boroughs, by the chief burgess, and in cities, by the mayor thereof: Provided, That in cities where a Commission exists for the care of public parks, the term and appointment of such Commission shall not be changed by this act, but shall be and remain as provided by the act of Assembly, and by the ordinance of councils creating such Commission for the care and maintenance of public parks. And such Shade-tree Commission shall, twice in every year, report in full its transactions and expenditures for the municipal fiscal year then last ended, to the authority under and by which it was appointed: Provided, That an existing park commission, acting under this enactment, may embody its report in its regular report to the councils, as by law or ordinance provided.

Acceptance to this act.

Terms of commissioners.

Appointments.

Proviso.

Annual report.

Proviso.

Section 3. That when such shade-tree commissioners, or park commissioners so acting, shall propose the setting out or planting or removing of any shade-trees, the material changing of the same in any highway,

Tree planting, etc.

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they shall give public notice of the time and place appointed for the meeting at which such contemplated work is to be considered, specifying in detail the highways, or portion thereof, upon which trees are proposed to be planted, removed, or changed, in one or more —not exceeding two in all—of the newspapers published in said township, borough, or city, once each week for at least two weeks, prior to the date of said meeting. Notice shall be published.

Section 4. The cost of planting, transplanting, or removing any trees in any highway, and of suitable guards, curbing, or grating for the protection thereof, when necessary, and of the proper replacing of any pavement or sidewalk necessarily disturbed in the doing of such work, shall be borne by the owner of the real estate in front of which such trees are planted, set out, or removed; and the cost thereof as to each tract of real estate shall be certified by the commissioners to the township commissioners, or to the presidents of the councils in boroughs and cities, and also to the person having charge of the collection of taxes for the said township, borough, or city; and upon the filing of said certificates, the amount of the cost of such improvement, of which notice shall also be given to each property owner involved, accompanied with a copy of the aforesaid certificate, together with a notice of the time and place for payment, shall be and become a lien upon said real estate, in front of which said trees have been planted, set out, or removed; said lien to be collectible, if not paid in accordance with notice as herein provided, in the same manner as other liens for taxes are now collectible against the property involved. Cost of planting, transplanting, etc. Certificates. Lien.

Section 5. The cost and expense of caring for said trees after having been planted or set out, and the expense of publishing the notices provided for in section three, shall be borne and paid for by a general tax, to be levied annually in the manner that taxes for township, borough, and city purposes are now levied in such townships of the first class, borough, or cities; such tax not to exceed the sum of one-tenth of one mill on the dollar on the assessed valuation of the property in such townships of the first class, boroughs, Cost of care and publication. Tax.

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or cities; and the needed amount shall each year, in due time, be certified by the shade-tree commissioners to the proper authorities charged with the assessment of taxes in said townships, boroughs, or cities, to be assessed and paid, as other taxes are assessed and paid, and to be drawn against as required by said commissioners, in the same manner as moneys appropriated for township, borough, or city purposes, are now drawn against in said townships, boroughs, or cities:

Proviso.

Provided, That the commissioners of any township of the first class, and the councils of any borough or city, accepting the provisions of this act, may provide for the expense of the maintenance of trees on highways,

Appropriation.

in accordance with the provisions of this section by actual appropriation, equal to the amount certified to be required by the said Commission, in lieu of the specific assessment above authorized.

Section 6. The Commission, under which the provisions of this act shall be carried out, in any township of the first class, borough, or city, shall have power

Superintendent, engineer, wardens, etc.

to employ and pay such superintendents, engineers, foresters, tree-wardens, or other assistants, as the

Regulations.

proper performance of the duties devolving upon it shall require; and to make, publish and enforce regulations for the care of, and to prevent injury to, the trees on the highways of any township, borough, or

Fines and penalties.

city accepting the provisions of this act; and to assess suitable fines and penalties for violations of this act, provided such regulations shall have been published at least twice in one or more, not exceeding two, newspapers of the township, borough, or city, involved, after having been submitted to and being approved by the commissioners of the township of the first class, or the councils of the borough or city affected; and such fines and penalties, so assessed for violations of this

Liens.

act, shall become liens upon the real property of the offender, and be collectible by the constituted authorities as liens for taxes upon real property are now collected.

Disposition of fines, etc.

Section 7. All the moneys due and collected from fines or penalties or assessments, in consequence of the acts of said Shade-tree Commission in enforcing this act, shall be paid to the treasurers of the town-

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ships, boroughs, and cities accepting its provisions, and shall be placed to the credit of said Commission, subject to be drawn upon by the said Commission for the purposes of this act.

Section 8. All acts and parts of acts inconsistent with this act are hereby repealed. Repeal.

Section 9. This act shall take effect immediately; but its provisions shall not be and become binding upon any township, borough, or city until it has been duly accepted, as provided in section two.

Approved—The 31st day of May, A. D. 1907.

EDWIN S. STUART.

SURVEYS.

The Department has completed during this year the surveys of three large reserves. The Caledonia Division of the South Mountain Reserve was finished by the survey of what is known as the Dale and Toland purchase. This survey closed up the northern part of Adams county and the southern part of Cumberland county, and was made by O. D. McMillan, of Gettysburg, Pa.

The Nittany Mountain lands, situate in the Nittany Mountains, Centre county, extend from the summit of Nittany mountain, inclosing Green's Valley with the famous Fishing creek, and Brush mountain down to near the Penn's valley farm lands, to the northeast of Centre Hall. The reserve takes in portions of lands lying in Potter, Spring, Gregg, and Walker townships. This survey was made by Charles L. Wetzel, of Beavertown, Pa.

The Aughwick Valley reserve, situate in Fulton and Franklin counties, was also completed this year, having been surveyed by Jonas Lake, of Laidig, Pa. This reserve covers portions of Dublin and Todd townships, Fulton county, and Metal and Peters townships, Franklin county, embracing lands from the foot of Tuscarora mountain, on the south, inclosing Aughwick valley and extending to the summit of Cove mountain, on the north. It lies but a short distance north of Richmond Furnace.

In addition to the above three completed surveys, the following general surveys were made during the year:

Mifflin and Snyder counties, on Jacks mountain; lands known as the Pardee purchase, surveyed by James Middleswarth. These lines are the most southern of the vast region now owned by the

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Commonwealth in the famous seven mountain region. This survey embraced lands from the foot of Jacks mountain, on the south, over several ridges and mountains, including Weikert Run and Rapid Run, extending to Penn's creek on the north. Mr. Middleswarth covered a distance of over thirty-three miles of lines.

Centre County: This survey consisted of lands in the same general neighborhood as the last mentioned, but included the Poe Valley section of lands purchased from William Whitmer & Sons Company, of Sunbury, and others, and extended from Penn's creek below Paddy mountain tunnel, on the Lewisburg and Tyrone Railroad, almost to the Lewistown and Bellefonte turnpike, inclosing the two Poe mountains, Paddy mountain, and the three branches of Poe creek with the two Poe Valleys, in one of which still live the descendants of some of the original settlers. This survey was in charge of William M. Grove, of Spring Mills, Centre county, Pa.

Centre and Union: This survey extends eastward from the corner of these two counties almost to the Forest Inn Hotel, in the Brush Valley Narrows, a few miles north of Mifflinburg and includes the eastern end of Paddy mountain and the southern side of Buffalo mountain. It inclosed lands purchased from W. E. Smith, the Pardees and Laurelton Lumber Company, as well as some smaller tracts purchased of others. The survey was in charge of Calvin Hayes, of Hartleton, Union county Pa. The surveys of Mr. Hayes and Mr. Middleswarth have almost completed the southern line of State lands from Bannerville, in Snyder county, to Forest Hill, in Union county, a "bee line" distance of twenty-four miles, but a property line distance of more than three times that many miles.

Centre county, Pine creek district: These surveys were made by Calvin Hayes, William M. Grove and Calvin M. Neff, and included lands on the north side of the Buffalo range of mountains, covering Pine Creek Valley and Brush mountain, purchased chiefly from the Laurelton Lumber Company. The lines of this survey extend from a short distance south of Potters' Mills, in Centre county, pass south of Spring Mills, Coburn, Woodward, and end about three miles southwest of Livonia.

Centre and Clinton District; This survey began in the eastern end of Sugar Valley, Clinton county, near the Tea Spring, and extended southwestwardly until it joined the last mentioned survey, southwest of Livonia. This survey was made by J. D. Eckel, of Clinton county, and covered lands purchased chiefly from Monroe H. Kulp & Company, of Shamokin, Pa. This also completed the survey of the northern line of State forest lands from near Potter's Mills to the head of Fishing Creek, in Sugar Valley, a "bee line" distance of some twenty-seven miles.

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PLATE VII. Mountainside Stripped for Hemlock Bark Only. Valley of Kettle Creek, Forest Reserve, Potter County.

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Clinton County District: This region includes the lands lying between the beautiful oval shaped Nippenose Valley and the Susquehanna river, west of Antes Fort on the Pennsylvania Railroad, and covers lands purchased from Jacob Quiggle and others. This survey was made by M. E. Shaughnessy, of Lewisburg, Pa.

Lycoming County: The only survey made in this county by the Department this year was made in the Bald Eagle Mountains, enclosing lands known as the Vincent lands, purchased from Monroe H. Kulp & Company, of Shamokin, and was begun by J. D. Eckels, of Loganton, Clinton county, and finished by the Department surveyors.

Clearfield County; This survey was made by Thomas W. Moore, of Curwensville, and covers lands purchased from Hon. Cyrus Gordon, Oscar Mitchell, and others, and includes the Clearfield Game Preserve.

Cameron County; This district is composed of lands purchased from the Pennsylvania Joint Lumber and Land Company, George B. Barclay, and others, and covers the headwaters of Wykoff Run, Jerry Run, and Mix Run. This survey was more difficult to make on account of the distance to bring in supplies, and the fact that no place could be secured for quarters, except in tents. The work was in charges of Victor A. Brooks, of Sinnemahoning, Pa.

Tioga County: This survey covered lands lying near to Ansonia, along Pine Creek and Marsh Creek, purchased from the Pennsylvania Joint Lumber and Land Company. The steep high mountains of this district made the survey difficult. The work was in charge of Ernest H. Green, of Wellsboro, Pa.

Pike County: This survey covered the lands surrounding the Promised Land pond, or lake, a fine sheet of water at the head of the east branch of Paupac Creek, and was made by Frank Schorr, of Milford, Pike county, Pa.

LINES AND CORNERS.

All the lines were carefully marked after the final running, by blazing the line trees and painting the blazes white. All old stone corners were rebuilt. Where new corners were made, large piles of stone were laid up in a substantial manner, and where trees stood near, they were notched with three notches facing the corners, as witnesses or pointers. These notches were also painted white. At all road crossings and paths where there were trees, the State Forest Blaze, or symbol of the hour glass, was cut into the tree and

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also painted white. The linen posters containing the rules of the Forestry Commission were posted at corners, road crossings, and paths.

The appropriation for the survey did not admit of the completion of the lines of any of the other large reserves.

COUNTY AND TOWNSHIP LINES.

In order to fix more correctly the lines of the counties, where reserves are located in several adjoining counties, it has been necessary to make careful searches of existing records, as well as the present "lived-to" custom, in order to get at the actual location of the county lines. These have been run and located on the ground and properly marked by a flitch with one notch above and one notch below, and all painted white.

The township lines have been extended into the county lines so that we could ascertain more correctly the exact acreage each township would have for road and school tax payments. The township lines have been very difficult to locate, as in rare instances are there any records of their being erected by actual survey or the older townships being divided by actual survey, while, in many cases, the road supervisors would use one imaginary line for their purposes, while the school boards would use a different one for their purposes.

DRAFTING.

The Department has been greatly handicapped by reason of the lack of warrantee maps of the various counties in which it now owns forest lands. In the effort to secure contiguous tracts or warrants, it has frequently been unable to reach a decision by reason of the absence of authentic maps, and in many cases it has depended solely upon local help.

During 1907, this Department has accumulated a great number of valuable drafts and a large amount of data, and is gradually making up county and township maps of those counties in which the various reserves are situate, securing data from official records in the Department of Internal Affairs, and actual careful surveys on the ground. These maps, when completed, will enable the Department to locate all the mountains, streams, roads, railroads, and towns, as well as the original warrants and the present county and township lines.

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The maps and drafts are all properly filed in the Department drafting room, and separately indexed in a complete and substantial manner.

Special, corrected drafts are also being made as rapidly as possible for the use of the Foresters, Rangers, and others, now employed on the various reserves.

DAVID B. MEREDITH.

Superintendent, Caledonia Division, South Mountain Reserve.

At the beginning of forest administration by this Department we had no foresters to take charge of reserves. The Academy was not then established, and it was not found possible or expedient to bring in foresters from outside. So a number of competent men were appointed superintendents of definte areas. One of these was David B. Meredith, who took charge of the Caledonia Division in May, 1902.

Colonel Meredith occupied the forest headquarters near Graeffenburg Inn until the time of his death which, after a lingering illness. occurred December 8, 1907.

With his assistance, the survey of this Division was nearly completed by S. V. Wingert, County Surveyor, and under his direction many miles of fire lanes were cut around the outside of the Division and kept clear by subsequent cuttings from time to time.

Colonel Meredith was most deeply interested in the work of the Department, and took especial pride in the administration of affairs on his own Division. He was prompt to resent anything which looked like an attempt to infringe upon the State's prerogatives, and for this reason his administration was minute and careful in all its details. He was ably assisted by his rangers, B. F. Hassler, James E. Carbaugh, James McElwee, and Edward Staley, who were loyal to their chief, proud of their work, and ready and willing to carry out every instruction.

David B. Meredith left to survive him, his widow, Henrietta J. Meredith.

He was laid to rest in the family plot in Shippensburg cemetery on the 11th day of December, 1907.

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SPECIFIC FOREST ADMINISTRATION.

Under the subject of Specific Forest Administration, there are contained hereinafter reports of the State Foresters and a report upon the purposes of the Forest Academy, a statement of revenue derived from the Federal Refractories Company's lease, and the fixed charges paid this year to school and road districts to compensate for the loss of taxes by withdrawing the forest reserves from taxation. There is also a paper on the planting of trees in streets by the Deputy Commissioner of Forestry. The consulting forester to the Department has contributed a statement of the position which the Department should assume toward chestnut culture, the report of an examination made of a plantation of Carolina poplar, growing near Tyrone, Blair county, a summary of the administration of the camp sanatorium, a discussion of "Deer Farming," and a paper on the timber now found on the reserves. Hon. S. B. Elliott, a member of the Commission, has also submitted an article on tree planting, and another on the growth of white pine in Tioga county.

FOREST NURSERIES.

MONT ALTO NURSERY.

The report of the Mont Alto nursery for this year will be found in detail as rendered by Forester Ralph E. Brock, in the report of State Forester George H. Wirt on the Mont Alto Division of the South Mountain Reserve. Nothing further thereon need be said at this place, except that it is the determination of the Department to bring this nursery to the highest degree of efficiency. To this end the soil is being supplied with ingredients to render it most suitable for the purpose. A part of it being cold, low, and wet, will take considerable labor and expense to raise it to the degree of efficiency desired. When this part of the work is finished we may look for unusually good returns from this nursery.

ASAPH NURSERY.

The nursery at Asaph, which was begun under the joint supervision of Foresters Robert G. Conklin and William L. Byers, was

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PLATE VIII. Future work for the Department of Forestry. Hills Along Kettle Creek, Forest Reserve, Clinton County.

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placed in charge of Forester Paul H. Mulford in the latter part of the year. Mr. Conklin was transferred to the Caledonia Division of the South Mountain Reserve after the death of Superintendent David B. Meredith, and Mr. Byers was transferred to the reserve in Bedford county, leaving the lands in Tioga county near Asaph and the nursery at this place under the charge of Forester Mulford. The detailed report of the operations of this nursery will be found in the report by Forester Robert G. Conklin hereinafter contained. The transfers above mentioned not having been made until about the end of the growing season, the report was submitted by Mr. Conklin.

GREENWOOD NURSERY.

The nursery at Greenwood was begun by Forester William L. Byers, previous to his transfer to the nursery at Asaph. He was succeeded by Forester William H. Kraft, now in charge of the reserve in northeastern Huntingdon county. Under Mr. Kraft's direction the work there is progressing well and favorably.

The germination of the seedlings in this nursery seems not to have been so favorable as in the others. For this reason the number of seedlings is probably not up to the standard we expected. The ground however was in such a condition that a great deal of work was necessary to bring it up to the point where forest seedlings can be raised with ease and a fair degree of success, and much of the time and expense bestowed upon this nursery was directed largely to this end. The inventory at the nursery at the end of the growing season this year, is as follows:

White pine,	500,200
European larch,	6,550
White ash,	1,800
Scotch pine,	5,500
Black locust,	180
Butternut hickory,	27
Shellbark hickory,	58
Pignut hickory,	82
Total all species,	514,397

The expenditures thus far made upon this nursery include cost of labor, seeds, and tools, and to the end of 1907, are as follows:

Various items of expense, 1906 (W. L. Byers, Forester),	$128 20
Labor from April to Dec. 1907 (W. H. Kraft, Forester),	671 35

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Tools, 1907,	7 90
Seed for planting nursery, 1907,	246 35
Salary of Forester from April to Dec. 1907 (7 months),	525 00
One Iron Age Cultivator, complete,	7 00
Two wheelbarrows,	10 80
Total,	$1,596 60

The average cost of the seedlings standing in the nursery at the end of 1907 is thus shown to be $3.11 per thousand. This rate is too high, much higher than we expect it to be in the future. After nurseries are well established and begin to run along smoothly, the cost of producing seedlings can and should be kept down to a rate very much below the rate shown at Greenwood. The fact that the rate is high is no fault of the foresters but of the conditions which must be met in establishing a new nursery. Another reason for the high rate is that the salaries of the foresters were charged against the nursery and not jointly against it and the reserve, which would be a fairer method showing a smaller cost per thousand for seedings.

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TRANSFER OF THE CAMP SANATORIUM.

Hon. Robert S. Conklin, Commissioner of Forestry, Harrisburg, Pa.:

My Dear Sir: My last report to you of the general condition and work at the South Mountain Camp Sanatorium was up to January 1, 1907. On June 1st of that year, this Camp was, by authority of the Legislature and at the request of this Department turned over to the Department of Health. Our relation to this work having now ended it is proper to make a brief statement of the organization and of the service rendered by the institution, which was at that time unique.

So far as we know, no similar institution of the kind existed anywhere in the United States. It was not a sanatorium in the ordinary sense of the word; the State simply provided a plain cabin, air, water, fuel, and medical attendance up to August, 1906. From that time until June, 1907, it was possible for us to open a kitchen and dining hall and supply the patients with food. Previous to this date, August 1st, the term Camp Sanatorium was directly correct, as the patients were merely campers there, providing and preparing their own food, the cost to the State therefor being per year for each patient less than $20.00.

It is safe to say, that of those who came to the camp afflicted with tuberculosis, about 75 per cent. were discharged either cured or with the disease arrested. This certainly placed the camp on the list of triumphant successes, and it raises the thought whether or not the camp idea, exclusive of feeding patients, might not well be extended upon the forest reserves to embrace the thousands of ailing citizens who are not yet upon the sick list, but who simply need a suitable outing to restore them to health and to a working condition. To place this idea in the most cold blooded form, it might be stated that, whether in or out of such an institution, the State at large in one way or the other is ultimately obliged to care for a large proportion of those who would seek the advantages of such an institution after they have fallen into the condition of chronic invalidism. This idea is, therefore, well worth consideration on the score of economy alone, leaving the element of philanthropy entirely out of consideration.

It is entirely proper that the Forestry Department may here lay claim to the following:

First. The idea of such a camp originated with it.

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Second. The success of the institution and its benefits to the public may, therefore, be credited to the Forestry Department up to June 1, 1907.

Third. The discovery of a suitable point for the location of such an institution and the demonstration of its suitability are also to be credited to the Forestry Department.

Fourth. The public interest awakened by the successful work of the camp prompted a careful legislative examination which aided materially in securing the large appropriation made by the last legislature for conducting a vigorous war against tuberculosis in Pennsylvania.

Fifth. During the period of five years in which this experiment was conducted, the institution received from the State but $23,000, with which suitable buildings were erected and the patients cared for; hence, the great work accomplished with this small sum is evidence of a wise and careful administration of the affairs of the camp.

It should be added, that in addition to this sum, private charity bestowed upon the institution a sum in the aggregate about $3,000, and that three cabins were also erected by contributions received from individuals, or from the Women's Clubs of the State.

It is a matter of great satisfaction to us that the continuance of this work and its enormous enlargement upon a liberal basis has been made possible by the generous appropriations of the last legislature, and that the institution is now in the hands of so competent and zealous a director as the present Commissioner of Health.

Appended to this report will be found a statement made by Dr. A. M. Rothrock, who is at present the medical officer in immediate charge of the camp.

J. T. ROTHROCK.

June 1st, 1907.

REPORT OF SOUTH MOUNTAIN CAMP SANATORIUM FROM JANUARY 1, 1907, TO MAY 31, 1907, INCLUSIVE.

A. M. ROTHROCK, M. D., Camp Physician.

During the period of five months from January 1, 1907, to May 31, 1907, inclusive, we have treated forty-seven cases in the camp and of this number nineteen were discharged during these five months. The following table shows the result of these discharged cases:

Disease arrested,	6
Much improved,	4

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Improved,	2
Unimproved,	5
Death,	1
Left less than a week after entering camp (cause homesickness; good case),	1
	19

Of this number the five who left us as unimproved were all far advanced in the disease when they entered the camp and would have been sent to an infirmary if we had one instead of to a camp for incipient cases.

The average weight of our patients on entering camp was 117.67 pounds, while the average weight up to date, including those who left, is 132.28 pounds.

Twenty-eight patients remain with us and of this number twenty-six are steadily improving, one remains in about the same condition as last month, and one who entered camp very ill is losing ground.

Twenty-nine patients remained in camp on January 1, 1907.

By act of the Legislature approved June 1, 1907, P. L. 381, the control and management of the Camp Sanatorium were transferred to the Department of Health. With the close of this report, therefore, the Department of Forestry relinquishes its management, which was taken over on the date stated, and is now being carried on by the newly created Department of Health.

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FIXED CHARGE ON STATE LAND.

A Statement of the Amount Paid for Road and School Purposes in 1907, Under the Act of April 5, 1905, P. L. 111.

Under the provision of the above act, the Commissioner of Forestry drew his warrants to the treasurers of school districts and boards of supervisors for the amount due them respectively, by reason of the location of forest reserves within their districts or townships, at the rate of 2 cents per acre for road purposes and 3 cents per acre for school purposes. In some instances it will be seen that for certain districts or townships the computation was based upon different areas. This was because at the time of settlement, when the land was purchased, one or the other of the above taxes was provided for or paid. For this year, in all such cases where the taxes were provided for or paid, the Commonwealth paid nothing, even though it enjoyed these tracts in ownership for a portion of the year 1907.

County.	Township.	Acres.	Amount paid for road purposes.	Amount paid for school purposes.
Adams,	Franklin,	3,577	$71 54	$107 31
	Hamiltonban,	3,526	70 52	105 78
	Menallen,	5,738	114 76	172 14
Bedford,	Colerain,	1,432	28 64	42 96
	Cumberland Valley,	431	8 62	12 93
	Southampton,	7,072	141 44	212 16
Cameron,	Gibson,	20,339	406 78	*443 31
	Grove,	29,142	582 84	*676 02
	Ind. Dist.,	12,170	.....	365 10
	Lumber,	9,646	192 92	289 38
	Portage,	2,821	56 42	84 63
	Shippen,	2,930	58 60	87 90
Centre,	Burnside,	18,280	365 60	†295 71
	College,	606	12 12	18 18
	Ferguson	2,000	40 00	60 00
	Gregg,	3,239	64 78	97 17
	Haines,	13,018	260 36	390 54
	Harris,	11,740	234 80	352 20
	Miles,	8,389	167 78	251 67
	Penn,	6,370	127 40	191 10
	Potter,	4,762	95 24	142 86
	Rush,	3,038	60 76	91 14
	Snow Shoe,	803	16 06	24 09
	Spring,	1,100	22 00	33 00
	Walker,	1,350	27 00	40 50

*Decreased by amount paid Independent District.
†Decreased by amount paid Jones Independent District, which contains 8,423 acres in this township.

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County.	Township.	Acres.	Amount paid for road purposes.	Amount paid for school purposes.
Clearfield,	Covington,	495	9 90	14 85
	Huston,	7,861	157 22	235 83
	Karthaus,	4,017	80 34	120 51
	Pike,	1,621	32 42	48 63
	Pine,	14,989	299 78	449 67
	Sandy,	610	12 20	18 30
Clinton,	Beech Creek,	9,148	182 96	‡119 64
	Castanea,	226	4 52	6 78
	Chapman,	20,460	409 20	613 80
	Colebrook,	1,816	36 32	54 48
	Crawford,	671	13 42	20 13
	E. Keating,	3,469	69 38	§104 07
	Gallagher,	1,514	30 28	‖17 13
	Greene,	1,130	22 60	33 90
	Grugan,	10,057	201 14	301 71
	Lamar,	1,212	24 24	36 36
	Leidy,	4,690	93 80	140 70
	Noyes,	18,676	373 52	**503 43
	Pine Creek,	740	14 80	22 20
	Wayne,	5,511	110 22	165 33
	W. Keating,	2,475	49 50	74 25
Centre, Clinton,	Jones Ind. Dist.,	15,478	.....	464 34
Cumberland,	Dickinson,	860	17 20	25 80
	Hopewell,	444	8 88	13 32
	Southampton,	1,172	23 44	35 16
Dauphin,	Jackson,	3,354	67 08	100 62
Elk,	Benezette,	1,980	39 60	59 40
	Horton,	283	5 66	8 49
Franklin,	Fannett,	2,962	59 24	88 86
	Greene,	12,311	246 22	369 33
	Guilford,	2,339	46 78	70 17
	Hamilton,	816	16 32	24 48
	Letterkenny,	3,197	63 94	95 91
	Metal,	660	13 20	19 80
	Peters,	220	4 40	6 60
	Quincy,	11,017	220 34	330 51
	Southampton,	2,890	57 80	86 70
	Washington,	2,050	41 00	61 50
Fulton,	Dublin,	1,471	29 42	44 13
	Todd,	4,369	87 38	131 07
Huntingdon,	Barree,	2,218	44 36	66 54
	Brady,	595	11 90	17 85
	Cass,	3,564	71 28	106 92
	Franklin,	2,300	46 00	69 00
	Jackson,	25,236	504 72	757 08
	Lincoln,	500	10 00	15 00
	Logan,	2,780	55 60	83 40
	Miller,	1,316	26 32	39 48
	Morris,	625	12 50	18 75
	Penn,	313	6 26	9 39
	Porter,	3,259	65 18	97 77
	Shirley,	2,321	46 42	69 63
	Spruce Creek,	1,400	28 00	42 00
	Tod,	1,197	23 94	35 91
	Union,	573	11 46	17 19
	West,	3,385	67 70	101 55
Juniata,	Lack,	356	7 12	10 68
	Milford,	95	1 90	2 85
	Tuscarora,	890	17 80	26 70
Lackawanna,	Lehigh,	2,854	57 08	85 62
Lycoming,	Brown,	12,338	246 76	.....
		16,133	.....	483 99
	Cummings,	14,003	280 06	.....
		14,493	.....	434 79
	Gamble,	3,380	67 60	101 40
	McHenry,	3,825	76 50	*48 81
	Plunketts Creek,	8,224	164 48	246 72
	Washington,	3,805	76 10	114 15
	Watson,	1,131	22 62	33 93
Lycoming, Clinton,	Barton Ind. Dist.,	3,141	.....	94 23

‡Decreased by 5,160 acres, this area lying within Jones Independent District.
§Decreased by (?) acres within the Jones Independent District. No survey being had to show the area of the district in this township, no part of the school charge was paid to the District.
‖Decreased by 943 acres included within the Barton Independent District.
**Decreased by 1,895 acres within the Jones Independent District.
*Decreased by 2,198 acres lying within Barton Independent District.

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County.	Township.	Acres.	Amount paid for road purposes.	Amount paid for school purposes.
Mifflin,	Armagh,	17,953	359 06	538 59
	Bratton,	8,105	162 10	243 15
	Brown,	7,117	142 34	213 51
	Decatur,	411	8 22	12 33
	Menno,	258	5 16	7 74
	Union,	202	4 04	6 06
	Wayne,	4,128	82 56	123 84
Monroe,	Barrett,	1,131	22 62	33 93
	Middle Smithfield,	2,017	40 34	60 51
	Price,	3,008	60 16	90 24
Perry,	Jackson,	10,942	.....	328 26
	Madison, S. W.,	399	.....	11 97
	Toboyne,	3,954	.....	118 62
Pike,	Blooming Grove,	11,391	227 82	341 73
	Delaware,	1,252	25 04	37 56
	Dingman,	4,240	84 80	127 20
	Greene,	2,366	47 32	70 98
	Lackawaxen,	2,356	47 12	70 68
	Lehman,	3,678	73 56	110 34
	Milford,	400	8 00	12 00
	Palmyra,	2,941	58 82	88 23
	Porter,	20,484	409 68	.....
		20,085	.....	602 55
	Shohola,	410	8 20	12 30
	Westfall,	2,550	51 00	76 50
Potter,	Abbott,	914	18 28	27 42
	Austin borough,	684	13 68	20 52
	East Fork,	1,455	29 10	43 65
	Homer,	9,422	188 44	282 66
	Keating,	4,440	88 80	133 20
	Portage,	10,326	206 52	309 78
	Stewardson,	11,495	229 90	344 85
	Summit,	15,025	300 50	450 75
	Sylvania,	4,744	94 88	142 32
	West Branch,	399	7 98	11 97
	Wharton,	6,749	134 98	202 47
Snyder,	Adams,	2,523	50 46	75 69
	Spring,	5,138	102 76	154 14
	West Beaver,	6,121	122 42	183 63
Tioga,	Chatham,	919	18 38	27 57
	Delmar,	5,420	108 40	162 60
	Duncan,	1,087	21 74	32 61
	Elk,	8,719	174 38	261 57
	Middlebury,	1,365	27 30	40 95
	Morris,	11,205	224 10	336 15
	Shippen,	13,968	279 36	419 04
Union,	Hartley,	19,059	381 18	571 77
	Lewis,	11,991	239 82	359 73
	W. Buffalo,	7,364	147 28	220 92
	White Deer,	3,206	64 12	96 18
Wyoming,	Eaton,	1,177	23 54	35 31

RECAPITULATION.

Total amount paid,	.....	$35,021 83
688,928 acres @ 2 cents per acre for road purposes,	$13,778 56	
708,109 acres @ 3 cents per acre for school purposes,	21,243 27	
		35,021 83

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THE FEDERAL REFRACTORIES COMPANY LEASE.

In the report of this Department for the years 1905-1906, there appears a detailed statement of the leasing of lands in Huntingdon county to the above corporation, from the beginning of operations under the lease of December, 1903.

For the current year, revenues from this source and expenditures to be charged against these lands, are as set out below. Royalty is paid by the lessee at the rate of 5½ cents per ton, and in addition, during the year it paid the sum of $90.94 for wood removed during the years 1906-07. This wood consisted of small trees, some of which fell down after the removal of rocks from the surface of the ground, and others which were in the line of the roadbed of the tramway. The compensation for trees thus destroyed was provided for in the original lease.

Revenues.

January, 1907, 996 31-224 tons,	$54 78
February, 1907, 1,203 145-224 tons,	66 20
March, 1907, 1,197 81-112 tons,	65 87
April, 1907, 1,297 193-224 tons,	71 38
May, 1907, 712 203-224 tons,	39 21
June, 1907, 1,241 41-224 tons,	68 26
July, 1907, 1,817 207-224 tons,	99 98
August, 1907, 1,354 89-224 tons,	74 49
September, 1907, 1,217 17-224 tons,	66 94
October, 1907, 1,154 1-56 tons,	63 47
November, 1907, 1,195 105-112 tons,	65 78
December, 1907, 391 29-56 tons,	21 53
Value of wood removed during 1906-07,	90 94
Total,	$848 83

To show the profit to the Commonwealth accruing from the above undertaking, the following account is stated as of December 31, 1907:

Purchase price of land, 1,087 acres, 69 perches at $2.75 per acre,	$2,990 44
Interest on purchase price, 2 per cent.,	354 53
Fixed charges for road and school purposes, 5 cents per acre,	163 09
Total,	$3,508 06

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Royalties received from the sale of rock previously reported,	$1,337 59	
Timber sold previously reported,	93 00	
Royalties from the sale of rock for the year 1907,	848 83	
Timber,	90 94	
Balance to be gained to recover investment,	1,137 70	
	$3,508 06	$3,508 06

From the above it will be seen that the profit to the State to date, is 67½ per cent. on the investment, with about sixteen years additional time for the lease to run.

The above calculation does not take into account the cost of the protection and patrol of the land since its purchase. If this be regarded the rate of profit on the investment falls to 41.85 per cent. The expenditures, therefore, still being in excess of receipts, it cannot be said that a net revenue is being derived, although at the present rate of income the latter will overtake the former within a few years.

STATE FORESTS AS WATER SAVERS FOR THE PEOPLE.

The importance of the State Forest to the citizen of this State is certainly made clear during every prolonged drought. The illustration of the "Water Dam" on Montgomery Creek, which supplies the town of Clearfield with pure water, gives a key to a situation which applies as well to other places in this State. It is in the headwaters of a mountain stream, the purity of which is guarded by the State owning the land and allowing nothing to remain on the ground which can defile the water. This water supply comes directly from the high hills. It is, therefore, above all drainage from infected, or infecting points. It goes in closed pipes to the distributing points, and is delivered in its original purity. There is sufficient head to carry it with force to stationary washstands in a six story hotel in Clearfield. It could be made immediately available on any floor for extinguishing fires. Furthermore, such a supply, coming from such a source, promises to be permanently abundant. The leaves and the roots conserve the rainfall which, in an open country, would run off as waste water, or as a freshet.

Some years ago, Lock Haven became alarmed about a threatening epidemic of typhoid fever. The disease was in a lumber camp,

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PLATE IX. Reservoir of Water Supply for Clearfield Borough, on State Reserve Lands.

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above the source of water supply. The town had just cause for alarm because the drainage from a dirty, diseased camp was directed into the drinking water of the people. The Forestry Commission was appealed to. In a short time that water shed passed into the possession of the State. Its care for water purposes was delivered to the municipal authorities, and a perpetual pure water supply was guaranteed to Lock Haven.

Two years ago the town of South Renovo was in straits for pure water. Sufficient wells seemed to be out of the question. The water of the river was considered unfit for locomotives, and could hardly be regarded any better for the people. Again the Forestry Commission was appealed to. In a short time an abundant supply of the purest water was made possible to the citizens of South Renovo, on the most reasonable terms.

The usefulness of the Forest Reserves of the State in this direction is only commencing to be recognized. It cannot be long until the struggle for water between the home dwellers and the manufacturing and transporting interests will be intensified, and every particle of the vast body of water which the forest cover of the State can hoard will be competed for. What is held by private parties will go to the highest bidder. What is held by the State ought to go first to the citizens for family use, and then what is left to other interests.

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REPORT ON MONT ALTO DIVISION OF SOUTH MOUNTAIN RESERVE FOR 1907.

GEORGE H. WIRT, State Forester.

The work of the year 1907 on the Mont Alto Division of the South Mountain Reserve has been a continuation of the work of former years to a very considerable extent. As such, several satisfactory advances over the work of former years have been made, while certain adverse conditions have brought about the same unsatisfactory results that were apparent formerly.

It has been our policy to push the matters of improvement, nursery, and plantations as rapidly and as far as possible. The report of Mr. Lewis E. Staley, Forester, who has been in charge of the improvement work since September, 1906, is here inserted.

IMPROVEMENT CUTTING ON MONT ALTO DIVISION.

Improvement work on the Mont Alto Division has been carried on mainly at two locations. Most of the time was consumed on a tract situate near Pondtown, locally known as the Guilford tract. The other tract is situate near the Pearl of the Park, one mile southeast of the State Forestry Academy, on both sides of the road leading from Mont Alto to the South Mountain Camp Sanatorium.

The Guilford tract comprises about twenty and one-half acres, and of this approximately seventeen acres have been cut over. The growth on the remainder of the tract is small and practically of one age gradation.

Many years ago most of this tract was worked for iron ore. Several large holes or mines were opened, and two large areas of several acres each, called mud-dams, were formed by the washing of the ore.

The ground in places has been filled in around the trees to a depth of several feet; the roots of many trees were cut by prospecting; the bark was chopped into and from some trees large chips have been removed and the wounds grown over. Evidently this, together with age, is responsible to a great extent for the condition of the stand.

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On this tract the predominating species were chestnut, red oak, and black oak, the first being common on the majority of the tract. On the rocky ridges were found some rock and white oak. Several hickory, pin oak, two ash, and a few black gum were also found. In most places a two story forest existed, the upper story being a stand of many large mature trees and many overmature trees, and the lower story a promising growth of young trees that average about ten years in age. The predominating species in the younger stand are rock oak and white oak. The older stand of trees ranged from seventy-five to one hundred and fifty-five years. One old oak was one hundred and seventy-six years old, as nearly as could be counted by the rings.

Cutting on this tract was begun in the latter part of September, 1906. About fifty-five cords of shingle wood were sawed into lengths of twenty-three inches. Some telephone poles and cord wood were also cut. About the latter part of November a number of trees were cut from which railroad ties were taken, the tops of the trees being cut into cord wood. It was soon realized that cutting into ties was not the most economic method of utilizing this material and in January, 1907, a local mill man was hired to move his mill into the tract, and orders to suit the timber were taken from lumber dealers.

The trees to be cut were first marked by the graduating class of the State Forest Academy, under direction. Only those trees were marked to be cut that were mature or, for some other reason, were on the decline. These, of course, composed the majority of the older stand.

Logging was mostly done by experienced woodsmen so as to avoid any unnecessary damage to the younger stand. When the logs were cut into lengths they were dragged to the mill by the mill-man's team. Dragging to the mill, sawing into sizes, and hauling to railroad was done by the 1,000 ft. B. M., while logging, loading on cars, etc., was by the hour.

Expenses were as follows per 1,000 ft. B. M.:

Felling trees,	$0 78
Trimming and swamping logs,	30
Dragging logs to mill,	1 60
Crosscutting into lengths,	71
Sawing into sizes,	4 00
Delivering lumber to railroad,	90
Loading on cars at railroad,	33
	$8 62

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The number of board feet cut for special purposes were:

Building cars,	46,641 bd. ft.
Building wagons,	36,381 bd. ft.
House construction,	38,854 bd. ft.
Blocking (used for loading machinery, etc.),	22,029 bd. ft.
Railroad ties (number of ties),	283
Waste (boards, odds and ends),	34,556 bd. ft.
Wire fence posts (number of posts),	24

Prices received for the lumber varied from $9.00 to $22.00 per 1,000 ft. B. M., and were as follows:

Car lumber,	$19 00 to $20 00
Wagon lumber,	22 00
House construction,	18 00 to 20 50
(Several long girders were sold at the rate of $25.00 per 1,000 ft.)	
Blocking,	12 00 to 16 00
Railroad ties:	
1st class white oak,	$0 60
2nd class white oak,	45
3rd class white oak,	25
1st class chestnut,	35
2nd class chestnut,	25

The bark was taken from 38 rock oak trees. When delivered to Mercersburg tannery the bark weighed 11,730 pounds. This was worth $9.00 per ton of 2,000 pounds delivered.

From the chestnut slabs and waste, plastering laths were taken.

Number of 4 ft. lath cut from quarter-cords of slabs:

Pile No. 1,	649
Pile No. 2,	581
Pile No. 3,	543

Average, 591 lath to a quarter-cord.

Some of these were sold at $4.50 delivered to Fayetteville, and the remainder will be used at the State Forestry Academy. The remainder of waste was cut into lengths of 12 inches and sold at the rate of $2.10 per cord at mill.

Aside from the lumber taken from this tract there was cut shinglewood for 86,300 shingles. Most of this wood was cut from crooked trees such as would not make logs of a desired length, or that were damaged in some way, or perhaps too small to be cut to advantage into dimension timber.

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Following is cost per 1,000 shingles for cutting into lengths, hauling to mill, etc.:

Cutting into lengths,	$0 91
Hauling to mill (average),	24
Sawing,	1 50
Baling,	25
Strap iron for baling,	07
Miscellaneous (saws, wedges, files),	12
Total cost,	$3 09

These shingles sell at from $4.75 to $5.00 per 1,000 4-inch shingles at mill. About 40,000 shingles will be used for State Forest Academy dormitory. The following number of shingles was sawed from three piles of shinglewood 8'x4'x23" or ½ cord in pile as shinglewood is ranked:

Pile No. 1,	879
Pile No. 2,	922
Pile No. 3,	884

Average per ½ cord, 895 4 inch shingles.

From the slashing of this tract cordwood has been cut at the rate of 60 cents per cord. The price per cord received for the wood varied from $1.40 to $2.00 per cord depending largely upon the amount of chestnut and quality of wood each rank contained.

This tract still contains a fairly good stand of young trees. Where good seed trees were found in most cases they were left standing for future seeding. An abundance of sprouts has started through the growing season of this year and it is hoped to have all the wood removed by February, 1908, so that there will be nothing to interfere when growth starts in spring.

The cutting near the Pearl of the Park was begun August 16, 1907. The area covered is about five acres. It extended from the road leading from Mont Alto to the South Mountain Sanatorium, about one-third mile up Brandon's Hollow, and about the same distance from Tarburner spring northeast along the ravine.

This was merely a thinning, only such trees being removed as were mature. White pine was the predominating species. Several hemlock and chestnut were also cut.

The trees cut ranged from seventy-five to ninety-five years old and from 60 feet to 112 feet from butt to tip of main shoot. No trees were cut under 25 inches in diameter, unless damaged in some respect. One tree cut along the Tarburner road measured 3 feet 8 inches in diameter, breast high, from which 1,641 feet of salable lumber were taken.

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The cost of setting a mill to saw a small tract is practically the same as for setting to saw a large tract. Therefore, this lumber cost more per 1,000 feet for sawing into sizes than the former tract, and was as follows per 1,000 feet B. M.:

Felling and trimming trees,	$0 93
Crosscutting into lengths,	81
Dragging to mill,	1 27
Helping driver to drag logs,	46
Cleaning up slashing,	01
Sawing into sizes,	5 00
	$8 48

The waste on this tract, such as tops and slabs, was of little value for fuel, being practically all sapwood, and was sold at the rate of 20 cents per cord as it came from the mill.

The branches of tops of trees left in the forest were lopped off and pressed as near to the ground as possible so that little time will be consumed in returning to humus.

	Guilford Tract.			Pearl of the Park.		
	Amount cut.	Sales.	Total receipts.	Amount cut. Bd. ft.	Sales.	Expenses.
Lumber,	124,376	$2,452 58	$3,282 50	*59,760	.....	$584 28
Waste boards,	13,161	158 18	.....	.....	.....	.....
Slabs,	†51	100 33	.....	.....	.....	.....
Shingles,	26,200	138 15	.....	.....	.....	.....
Plastering lath,	10,175	45 35	.....	.....	.....	.....
Railroad ties,	318	132 55	‡ 1,931 15	.....	.....	.....
Telephone poles,	13	21 50	.....	.....	.....	.....
Cordwood,	†112	208 76	.....	.....	.....	.....
Miscellaneous,	.....	25 10	.....	.....	.....	.....

*Worth on the average $20 per thousand or $1,196.20. †Cords. ‡Total expenses.

In addition to the $3,282.50 received from the sale of products, there were used in the Academy dormitory 11,697 feet of lumber worth $20 per thousand, or $233.94; 40,000 shingles worth $5.00 per thousand, or $200.00; and 9,530 plastering lath worth $4.50 per thousand, or $42.88 making a total value of $3,759.32, leaving out fifty to seventy cords of fire wood on hand to be chopped and ranked.

In addition to the above improvements, there were removed about five hundred cords of dead wood from Snowy Mountain, Sandy Ridge, Oak Mountain, Vineyard Hollow, and the Old Forge range. Small quantities of wood were removed from various other localities.

Respectfully submitted,

L. E. STALEY,
Forester.

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STATEMENT OF MONIES RECEIVED AT OFFICE OF THE FORESTER.

1907.	January.	February.	March.	April.	May.	June.	July.	August.	September.	October.	November.	December.	Total.
Bark,						$43 78							$43 78
Charcoal,								$18 00		$5 25			23 25
Feed,		$24 00	$21 00	$9 50		4 87		7 86					67 23
Fines,									$5 00				5 00
Flag pole,						12 00							12 00
Labor,							$4 83						4 83
Lamp supplies,	$0 30	50	20	30									1 30
Logs,	9 75			5 12			1 10	1 00					16 97
Lumber,			220 05	157 80	349 48	510 59	401 25	819 77	2 25	80			2,461 99
Manure,	10 50					1 25		1 50	75		$1 25		15 25
Oil,	66	22	3 41										4 29
Pine knots,			40						60				1 00
Posts,					1 44	7 50	7 25						16 19
Seed, clover,						50							50
Shingles,				1 00	6 00	13 85	10 25	24 25	69 30	12 50	1 00		138 15
Telephone poles,	262 50					41 25							303 75
Ties, railroad,					35 25					97 30			132 55
Ties, tram,			85 86										85 86
Wood, cord,	39 79	20 58	5 01	8 40	4 85	12 12	2 10	10 55	12 70	43 65	42 79	$66 40	268 95
Wood, cut,	40		75										1 15
Wood, old,			2 75			2 56		3 00	25	80	25	35	9 95
Wood, pole,	2 45	1 50		80		381 41	90	35	5 53	1 01	4 85	95	399 75
Wood, slab,		75	14 85	7 27	5 45	2 63	32 94	27 50	9 88	2 20	1 73	1 88	107 08
Wood, waste,			11 84	66 50	5 92	11 29	8 50	33 32	19 71	1 25	60	4 10	163 03
Wood, odds and ends,												50	50
Total.	$326 35	$47 55	$366 12	$256 69	$408 39	$1,045 60	$469 12	$947 10	$125 97	$164 76	$52 47	$74 18	$4,284 30

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From the foregoing statement it will be seen that the trees cut were utilized as far as was possible to the best advantage, and that everything was used up but the smaller branches; and that the operations paid well. This policy should hold good at all times. In most cases on this reserve an intense utilization pays immediately, and the few cases where it will not pay now, will more than pay in future value to young growth.

The report of Ralph E. Brook, Forester, who has had charge of the Mont Alto Forest Nursery, follows:

Mont Alto Nursery.

The work of the year 1907 has progressed rapidly and successfully. Considering the fact that the nursery is to be a permanent one, all efforts have been put forward to make it as nearly ideal as possible

The soil varies from a sandy loam to a stiff clayey sand and is very stony. During the past year much time has been expended in cleaning this area of stones and foreign material. In the middle of the field was a large hole from which clay had been taken for the manufacture of brick in the days of the Mont Alto Iron Company. This hole has always been both unsightly and in the way. It is now almost entirely filled with the stones carted off the nursery, and during next season it is hoped that it will be covered over and planted with trees of various species.

Weeding and Mowing.

Weeding was started in earnest early in the month of May and was kept up until late in September. Much was accomplished in the subduing of obnoxious weeds. The most difficult weed handled was the Galinsoga parviflora, a naturalized weed of the tropics, that has been in this locality for a comparatively short time, but now a bane to successful gardening. This weed is a tenacious plant and hard to eradicate by ordinary methods, as it propagates by root development. During the season nearly one hundred and seventy dollars were expended in the subduing of this weed alone. The wild carrot, once so prevalent, has been almost entirely removed. The wild radish and Canada thistle are still troublesome, but it is hoped that more will be done with these weeds in another year. The use of manure has been abandoned on account of the numerous weed seeds therein contained. During the months of July and August one man was kept busy almost the entire time mowing unused portions of the nursery and exterior adjoining reserve lands in the endeavor to stop the annual pollution of the nursery with wind disseminated weed seed.

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Area.

The total area set apart for nursery purposes approximates seven (7) acres.

The area of the old nursery (prior to 1907) comprised the following area:

Pine section, ...	5,880 square feet.
Large nursery, ...	21,420 square feet.
Total, ...	27,300 square feet.

During the year 1907 the enlarged area was:

Old nursery, ...	27,300 square feet beds.
Transplants, ...	6,700 square feet beds.
1-year seedlings, ...	15,288 square feet beds.
Tulip poplar, ...	4,760 square feet beds.
Hardwood rows, ...	112,500 square feet beds.
	166.548 square feet.

During the year 1908 the hardwood rows will be abandoned and beds used entirely. The area now prepared, not counting walks, for the work up to November 1, 1907 is:

Old nursery,	14,532 square feet.
Annex, ...	16,804 square feet.
New ground,	48,020 square feet.
	79,356 square feet actual bed surface.

Roads and Paths.

For convenience in hauling a road at right angles to the public road was laid out, and partly made. The road bed is nearly level and in another season this road will be covered with refuse from the saw mill and sprinkled with a chloride solution making plant growth upon its impossible. At regular intervals throughout the nursery paths will be laid out and filled with saw-dust.

Fertilizers.

As before stated the use of barnyard manure has been discontinued, and commercial fertilizers have been used to restore the soil to a proper condition of tilth. The use of lime has been found detrimental to coniferous and to some of the broadleaf seedlings and is now used only as a mechanical ingredient of the compost heaps.

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Wood ashes have been found to be one of the most important available materials and a considerable quantity of these has been gathered and used. Since its use healthier and more vigorous seedlings have been observed, also the growth of moss on the beds considerably lessened. During the past year all materials available for the forming of compost heaps have been gathered and heaps formed. There are now six large heaps in the nursery the first of which will become available for the next year's work.

BEDS.

The arrangement of the beds is to have them all with the long side parallel to the Mont Alto—Fairfield public road. This arrangement will make the wheeling of stone and composting material less burdensome, the irregularity of shades less conspicuous, and also allow of some natural shading. On account of extra weeding and the cleaning of paths, beds as long as the slope of the land will permit will be used. Walks and paths over one and one-half feet wide will be discontinued.

Sowing of Seed.

Excepting in the case of black walnut, shellbark hickory, hardy catalpa, white ash, and persimmon, all the seed was sown in well prepared soil. This year most of the seed was sown broadcast both on account of preference, and the limited time at hand. Before this was done, tests of the seed were made and the seed sown in such proportions as would produce the most favorable results, as shown in the following table of sowing, for one hundred square feet of bed surface, viz.:

	Broadcast, pounds.	Drills, pounds.
White Pine, Native,	1.2 —1.5	.8
White Pine, German,	1.8	.....
European Larch,	1.25	.....
Balsam Fir,	.....	.6—.7
Scotch Pine,	.....	.8

Hardwoods.

No definite scheme of sowing these seed was used during this season. The walnuts were sown 6″—8″ apart, and the smaller seed so that they would touch, except in case of the tulip poplar which were sown at the rate of 1.15 pounds per hundred square feet.

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Further Work.

Nothing of unusual interest was noted during the year, excepting that the tendency of the white pine to grow yellow in small sections throughout the lower part of the nursery, possibly caused by the lack of nitrogen in the soil. The usual methods of introducing free ammonia into the soil did not cause any appreciable result. The European Larch falls below the standard of height for one year seed. This is probably due to the condition of the soil. It is hoped during the next season to sow this seed in a lighter and more porous soil.

Table of Heights for One Year Seedlings.

Walnuts, ...	8″—31″	White pine, ...	2″—2.5″
Ash, ...	6″—17.5″	Scotch pine, ...	3″—5″
Catalpa, ...	8″—16″	Balsam fir, ...	.5″—1.5″
Persimmons, ...	2.5″—7″	European larch, ...	1″—3.5″
Shellbark, ...	6″—8″	Black locust, ...	3″—8″
Rock oak, ...	5″—10″	Tulip poplar, ...	1.5″—6″

There are two things which demand immediate attention if the work here is to be a decided success. These are a system of water pipes and a fence for protection. During the summer a tank of five barrel capacity was purchased as a temporary makeshift. It was impossible to haul water in sufficient quantity, especially in time of severe drought, as in the early part of August last when the temperature of the soil ran up to 104 degrees and no rain for several weeks. A fence is necessary to protect the nursery from being continually trampled over by cows, horses, and from scratching by fowls belonging to adjacent land owners and renters.

Total Costs.

Fertilizers, ...	$78 42
Tools, ...	37 28
Sundries, ...	98
Weeding, April 1-November 1, ...	219 25
Superintendence, ...	780 00
Miscellaneous labor, ...	357 30
Seed, ...	388 58
For 1907, ...	$1,861 81

Students' labor, 3,000 hours.

5—24—1907

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Inventory, November 1, 1907.

Fraxinus Americana,	23,198
Robinia pseudacacia,	1,300
Catalpa speciosa,	2,450
Diospyros Virginiana,	6,000
Quercus prinus,	369
Hicoria ovata,	635
Hicoria glabra,	2,950
Juglans nigra,	2,567
Liriodendron tulipifera,	500
Larix Europea,	53,600
Pinus strobus—1 year seed,	688,000
Pinus strobus—2 year seed,	189,000
Pinus strobus—Transplants,	9,000
Pinus sylvestris,	50,000
Pinus ponderosa,	500
Picea excelsa—2 year seed,	90,000
Picea excelsa—3 year seed,	73
Abies balsamea—1 year seed,	80,000
Total,	1,200,142

Respectfully submitted,
RALPH E. BROCK,
Forester.

Both Mr. Staley and Mr. Brock are to be commended for the careful and faithful attention they have given to their work, and especially for the success which they have attained.

In the spring of the year the planting at Caledonia was continued. Twenty thousand white pines were used to fill in the fail places of the other plantation and the remaining portion of the open ground on the east side of the Chambersburg and Gettysburg pike extending from plantation of last year toward the location of the old flint mill near Mount Union. Five thousand white pines and 500 honey locusts were planted at the "Mart. Carbaugh" place, and 1,200 honey locusts as a hedge about the Academy grounds. Two thousand willow cuttings were planted on the Monaghan field. In the fall there were planted on an open field of the "Irishtown" farm beyond Pondtown 630 shellbark hickory seedlings, one year old; 2,950 pignut hickory seedlings, two years old; 1,300 black locust seedlings, one year old, and 5,000 white ash seedlings, one year old. There were also planted by way of experiment 350 rock oak seedlings, one year old, on an old mud dam east of Pondtown. The total planting are the year in this locality was 36,930 seedlings, of which 21,930 came

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from the Mont Alto nursery; also 2,000 willow cuttings obtained from Delaware.

An inspection of the former plantations shows a satisfactory growth in all. In the summer it became necessary to remove from the white pine plantation of 1902 on Monaghan field several entire seedlings and a number of shoots which were affected by insects. These shoots were carried out of the plantation and burned. A measurement of one hundred and twenty-five trees unaffected shows an average growth for this year of sixteen and seven-tenths inches. The maximum growth for 1907 was thirty inches. A review of the growth since planting is as follows:

Average growth in height in 1904, 5.89 inches.
Average growth in height in 1905, 6.98 inches.
Average growth in height in 1906, 12.08 inches.
Average growth in height in 1907, 16.7 inches.
Height of tallest tree in plantation in 1907, 91 inches.

During the year one white pine cone was found on one of the small trees. It was of fair size and had several well formed seeds in it. The shoots of the willow plantation made an average growth of about twelve and five-tenths inches.

The experiment garden which was laid out on the Monoghan field was fenced early in the year, but owing to the work of the Health Department, and the fact that the land was turned over to that Department, the garden was abandoned.

During the summer the road from the Park to the Pearl of the Park was rebuilt and well graded under the direction of Superintendent David Knepper. There was practically no cutting done but the dips were filled (at one place five) feet with large stones well packed so as to bring the road up to grade. On top of the rough stones was placed a layer of crushed stone one to two inches in diameter varying from eight to twelve inches thick. On top of this was scattered screenings from the crusher and fine furnace slag. The road averages eight feet in width. The following is a concise statement with refence to the work:

Length of road in feet, ...	2,250	feet.
Average width of road, ...	8	feet.
Average depth of crushed stone, ...	12	inches.
Number of days work of crusher, ...	24	
Cost of crusher at $3.00 per day, ...	$72 00	
Cost of coal (17,620 lbs.), ...	33 48	
Days of cart hauling, ...	84	
Cost of carting at $2.50 per day, ...	$210 00	
Day labor at $1.50 per day, ...	473 00	
Labor by students of Academy, ...	450	hours.

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In the fall there were obtained about one hundred bushels of white pine cones from which fifty pounds of seed were obtained. These cost not more than about thirty-five cents per pound and are of a fair quality. There were also obtained about eighty bushels of black walnuts at about forty cents per bushel, and thirty-five pounds of yellow poplar seed at thirty cents per pound.

During the year this Division was almost entirely free from fires, there being only one, covering probably one hundred and fifty acres of reserve land. It was on Pine Mountain in Bricker's range.

The two principal difficulties of the year were with labor and lack of funds for tools and machinery. There were no grounds upon which we could insure permanent labor to any one although there is enough to keep a large force busy for several years continuously. Neither could we pay a price which would induce a day laborer to stay with an uncertain job when other jobs were paying higher wages and offering better inducements. As a result our work was unsatisfactory, at some times actually stopping, resulting in our loss, and at other times coming at a rush so that the best results could not be accomplished. By not having our own mill and appliances we are handicapped at all times for we cannot expect to get the best returns from our improvements if we count on hiring local mill men to move from tract to tract at a large expense to us.

Several improvements in the matter of accounts have been made. The "Labor Account Sheets" are of great value. A more thorough understanding of the "Time Sheets by" has made their use more appreciated, but at the same time it has shown the need of a uniform use of terms. As far as the individual's time sheets are concerned, there were very few of our laborers who could write, hence the time sheets were not desired by them. They were simply given to understand that the timekeeper's time was to be final. However, it should be insisted upon that the laborer keep his own time or have some one keep it for him on our time sheets. Card catalogues have been devised for keeping account of receipts from various operations and various products, as well as of the expense connected with the operations. Our system of inventory is not yet completed satisfactorily, but is on a fair road to completion early in the new year. It is an extremely difficult matter to handle where so many interests are concerned and where appliances are very frequently borrowed from one department to be used in another department and never returned.

The following is a brief statement of progressive steps still to be taken. Most of them have been dealt with in previous reports:

Road system planned and extended, to consist of two miles of main road to each square mile area, secondary roads and trails.

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All roads to be in control of Department.

A per acre allottment of money for road building.

Information in reference to wood utilization in the State so as to be of use to foresters in charge of reserves.

Purchase of small mills by Department.

Introduction of new industries in regions of reserves for utilization of small stuff.

Improvement of present large nurseries rather than establishment of others, except small ones in charge of rangers.

Rangers established on reserves to be men of credit and of good qualities; to report directly and on time sheets to Forester in charge of reserve; to be given to understand that watching for trespassers is but a small part of their duties; to have in charge the roads in their range and to be responsible for the condition of the same; to care for a small nursery and to help with the improvement work in their range; above all to be given telephone service.

Establishment of fire towers and system of fire signals and telephones.

Accounts to be kept on each reserve by Foresters and statement made to him each month or oftener of transactions by the Department with reference to his reserve, and statements of accounts to be made by Forester each month and forwarded to the Department.

Effort made to obtain a permanent force of laborers on each reserve and have them busy the entire year.

Purchase of interior tracts.

Permanent demarkation of boundaries where possible.

Determination of line between Mont Alto and Caledonia Divisions of South Mountain Reserve.

A definite charge of $5.00 for each bee tree to be cut with condition that the bees shall be cared for.

Manual for use and instruction of the Pennsylvania Forest Service.

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STATE FOREST ACADEMY.

There have been of late several references to the State Forest Academy in current forestry literature to the effect that the Academy is not fulfilling its original purpose or is trying to get away from that purpose. Such criticism can only be made in ignorance of the purposes of the institution and of its workings. It was established for the purpose of satisfying the immediate and future need of the State for men who could be placed in charge of the State forests to make them yield their greatest service to the State. Such a need is for men who are trained to meet practically and successfully the problems which they will have to solve in the management of the State forests, and these problems are not simply protection from man and fire. There is concerned the prodigious task of transforming barren, waste, or almost worthless mountain land into forest clad hills from which the State's people and industries receive incalculable blessings.

To understand even the first step toward bringing about such a transformation it becomes necessary that a man have a sufficiently trained intellect to grasp at least a few of the laws of plant growth, the requirements of plants, the relation of species to soil, effects of light and shade, etc. No two areas are exactly alike and a decision must be made as to the proper work for that particular area. For the complete transformation it became necessary to have an ideal, to understand it and to reach toward it; and this requires considerable training along various lines. There must be a consideration of the economic importance of the forest to the State, the principles of forest production and tendance, proper protection and utilization, organization, business regulation, and administration.

An attempt to impart such instruction to young men not having a common school education, was made and proved a failure. Consequently it became necessary to demand of all applicants such an educational standard as would insure a more or less satisfactory foundation upon which to build our superstructure with more certain expectations of the results. With each advance in requirements of admission thus far, better results are apparent. First there was the examination covering the common school branches and the physical examination then these examinations and the required bond.

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If the Academy was supposed to take uneducated boys and train them in the simplest affairs connected with forestry practice, with the intention of their filling the lowest grade in a forest service above that of laborer, then it has failed of its purpose, for it is doing better than that. It is supplying a demand of the State which is of more importance, namely, men who can manage its reserves and develop them in accordance with the purposes for which those reserves were established. Under present conditions each man in charge of a reserve can train his own rangers as well as it could now be done at the Academy. This is in accord with the idea that as far as possible the rangers and laborers should be drawn from the local population, an idea which needs no justification.

At the same time, it is also true that the demand for an educational standard as part basis for admission to the Academy may tend to reduce in number of appointees young men, brought up in the country, in wooded districts, and occasionally in the towns, who have strong constitutions, a love for outdoor life, and the woods especially, and plenty of good common sense, but who, it is claimed, have not had the opportunities of education such as is presented to young men in the cities, who unfortunately too often have everything needful but common sense and do not seem able to imbide any. Apparently this is a misfortune to the forest service and to the young men themselves. However, it has been the experience of all grades of schools that when a country boy desires to enter their doors, he has the "grit" to prepare himself so as to pass a creditable examination, and a fair proportion of country boys are in the higher schools of learning to-day. In this day, the boy who complains of no opportunity means by his complaint that he is lazy and has wasted opportunities. Too often our letters are from young men who do not like to study but simply love out-door work. The expression sounds like that of a boy who plays "truant" when he knows that he ought to be at school. Of course there are exceptions, but there is still a chance for them in the service if they really desire to enter it. It is not, then, a disadvantage to the State to eliminate the class of young men who have not the stamina to compete in an examination for which they can prepare in a comparatively short time. It takes a man with considerable moral fibre to do the duty demanded in the management of a reserve, and the entrance examination is a fair test along that line. Where it is not, the checks in the Academy will weed out the undersirable appointees.

It is more than probable that the adverse criticism is based upon the stand of requiring an educational qualification for entrance, and with it the completeness of the curriculum. Outsiders not under-

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standing the meaning of the term "warden" in our State laws have naturally decided that such a curriculum is utterly beyond the need of rangers and hence in speaking of the Academy as a "ranger school" are in error, where as we are warranted in giving the term "warden" its broadest meaning in accordance with our needs. Naturally, then, the next step in the outsider's thought is that the idea of "practical instruction" is not compatible with the maintenance of the present curriculum. That is not the fact. Such a curriculum might be handled from the theoretic point of view, alone, but the results would be quite unsatisfactory. At the same time the men who are needed on State reserves could no more be trained to the best advantage by practice alone than could a physician. However, a proper blending of theory and practice produce the best results and that is our object. Theory is necessary and we teach it, but it is taught in such a way that its practical application is patent. The natural conditions or objects are used wherever it is possible to do so, and at least half the time is devoted to practice out of doors.

Thoroughly considering the statements just given, I now ask for what I believe to be a step further in advance, namely, the elimination of the subjects of civil government, algebra, and plane geometry from the curriculum. Civil government and algebra are now subjects of examination. The examination should cover these three subjects in their entirety. Apparently this will be no hardship as most of the students in the last two classes have covered the subjects and preferred passing examinations in them here rather than cover the ground again. Such an elimination would make possible a more thorough consideration of silviculture, management, and work preparatory to mapping; all of which are very essential subjects.

I would further suggest that at the earliest possible date some arrangements be made so that a class of at least six men may be here each year as student rangers. These men might be some of the more progressive rangers in the service to-day, or may be young men who are adapted to the work, from the various localities in which reserves are situated, and who perhaps do not care to compete for appointment as a regular student of the Academy. These trained rangers could then be substituted for the present untrained and often uneducated men in those particular localities, or in others as the demand might be. The principal qualifications in these cases should be physical ability and general good character.

During the year 1907, the teaching force of the Academy has been changed and increased to the advantage of both the faculty and students. Prof. W. A. A. Reinhardt, graduate of Johns Hopkins

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University, has charge of chemistry, geology, physics, economics, and German, vice H. R. Kreider, resigned, and Prof. Joseph H. Illick, graduate of Lafayette College, has charge of the mathematics, elementary botany, physiography, and zoology.

The work of the instructors, and the students as well, has been above the average of past years, more than justifying the presence of the additional instructor. The general air of the Academy as expressed by the attitude taken by the students in their work and conduct has changed for the better. There is a growing spirit of interest in the work and a better conception of the need for men who are above the average.

The work of the field during the past year has been very satisfactory; however, there is still room for improvement in many ways. For the most part the students did their duty but there were some who shirked, and this will continue to be the case until a summary dismissal is made on the grounds of undesirability. The first summer's work must be made rigid enough to test "the nerve" of the student; for it is wise to discover the good men as early as possible, as well as the shiftless ones.

As soon as appropriations warrant, students should be given an opportunity to visit different reserves, utilization plants, and lumbering operations. The instructors of the forestry subjects should also be given these opportunities. They are expected to teach their subjects in accordance with the needs of the State reserves. How are they expected to know of those needs? This is an important proposition. The year has seen the beginning of a new dormitory and recitation building which will add materially to the Academy in many ways.

COMMERCIAL PULPWOOD PRODUCTION IN PENNSYLVANIA.

December 30, 1907.

Hon. Robert S. Conklin, Commissioner of Forestry, Harrisburg, Pa.:

Sir: Your consulting Forester reports that he has inspected the plantation of Carolina poplar growing near Tyrone.

This plantation was started nine years ago. Instead of cuttings, trees from six to ten feet high were planted. The rate of growth has been very unequal in spite of the fact that so far as could be observed the conditions of soil were much the same everywhere

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over the plantation. The only exception to this statement which was visible was that in some places the side hill has been dug and leveled off into a sort of floor for say fifteen feet. At such points the growth of the trees was markedly greater. On the average it is fair to say that on such level places where the soil has been loosened, the diameter of the trees at four feet from the ground was about five inches. In the other portion of the plantation the diameter of the trees was under four inches. From twenty-five to thirty feet would be about the average height throughout. It may readily be seen with a little more attention better results would have been attained. These trees were planted from ten to twelve feet apart.

There are now certain conclusions which may be safely reached from these statements.

1. The managers of the paper manufacturing company which planted the trees evidently are satisfied that Carolina poplar is a desirable wood for their purposes.

2. It is clear that the paper manufacturers are commencing to look with apprehension upon the growing scarcity of wood for production of paper.

3. The location of this plantation so far as soil and moisture are concerned is almost as unfavorable as is possible for Carolina Poplar. It is high up against the slope of the mountain where the soil is thin, cold, and dry; yet in spite of this, though the growth of the trees has been unusually slow for this species of tree, it may be safely affirmed that it is as great as usually made by more desirable species on better soil; and it may be confidently expected that in ten years more these trees will be ready to cut. After this the production of the second crop from the roots and stumps will follow more rapidly.

4. There are many acres now owned by the State which might be advantageously devoted to the growth of Carolina poplar for paper pulp purposes. Such for example are the lower, moist grounds which are not especially suitable for other species of trees but which are well adapted to the growth of the poplar. Near Graeffenburg, such location can be found. It should be remembered however that the young poplar shoots are eagerly eaten by browsing animals and that the trees should be protected against such danger.

In regard to the insect enemies of the poplar, I may say reports differ. In the case of the plantation in question it is said that the oyster shell scale covered the young branches and thus retarded the growth of the trees. It is further alleged that after spraying the trees promptly resumed vigorous growth. At the time of my visit there did not seem to be any scale on these trees.

On the other hand, I made inquiry of a most careful and competent

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observer as to whether or not he could see any danger to the Carolina poplar in his examinations over the State. He replied that wherever he had noted the presence of the San José Scale on the tree there was but little damage done, for the rate of growth of the tree was so great that it kept ahead of the scale.

These apparently conflicting statements may probably be reconciled. In the one case, a more fertile soil gave the tree the advantage over the scale.

I would, therefore, recommend that extensive planting of Carolina poplar be commenced by the State as early as possible. So far as I know no other tree promises to bring so speedy a return and for which we may so certainly expect a remunerative market.

Respectfully submitted,

J. T. ROTHROCK,
Consulting Forester.

GENERAL REPORT ON THE PENNSYLVANIA STATE FOREST RESERVE IN BEDFORD COUNTY.

WILLIAM L. BYERS, Forester.

This State now owns or has under control in this county at least nine thousand acres of mountainous land located in Colerain, Cumberland Valley, and Southampton townships in the southern portion of the county, including and surrounding the great Martin Hill, extending about one mile to the east of Rainsburg, south of Tussey Mountain to the Maryland State line, east as far as the foot of Tussey Mountain at the mouth of the Sweet Root Gap, and west as far as the west side of Evitts Mountain. The land was bought in four different portions. The first in 1902, the second in 1903, the third in 1904, and the fourth and last tract in 1907. The warrants were issued in the names of Cegg, Ketternan, Mouir, Herring, Whetstone, Roof and others. Most of this land was used to supply the bark for the tannery which was situated at Rainsburg. The rock oaks were cut and peeled, the bark taken, and the logs left to decay in the woods. Therefore, there is very little merchantable timber now standing on this land except along the streams and in small groups on the ridges. A few farms were also cleared on this land, such as the Wertz place, the Blankly, and the Ressler place. These places have not been cultivated for a number of years. They are growing up with forest, but in most cases are being covered with species of trees that are of no use for lumber.

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There are at present a small house and barn situated on the Blankly place which is used by the ranger as a lodge. The land for most part is covered with young chestnut, rock oaks, white oaks, yellow poplar, and locust of good growth and density. In the hollows along the streams are found old and mature white oaks, chestnut, rock oak, yellow poplar, etc. In one or two of the hollows is also to be found hemlock. There is a certain portion of this land that is covered with scrub oak, but in most every case where scrub oak is found you will also find young chestnut and rock oak about as high as the scrub oak which will in time become large and shade out the oak. Scrub oak is a species that never becomes large and it cannot endure shade. The scrub oak in most cases is the first tree to cover the land completely after a fire. It thus prevents erosion of the soil by water and also prevents rapid evaporation. Aside from this it has no use and should not be found in an ideal forest. On a few of the ridges are very good growths of chestnut and rock oak in dense stands, which should in a few years be thinned so as to give more room for the trees to mature. Along the stream there are found trees that have about reached their greatest development. These should, as soon as conditions allow, be cut out to give the younger growth a chance.

This land has been surveyed by different surveyors for the various owners and in some cases the surveys do not join properly. Many of the lines have been surveyed so long ago that it is impossible to follow them without the aid of a compass.

The reserve will be resurveyed as soon as possible. The outside lines will be marked by having numerous trees along the lines blazed and the blazes painted white. Notices will be prominently displayed and at intervals along the lines will be placed the mark known as the "State Blaze." This blaze consists of an "X" marked on the tree and then painted white. The blaze is put on the tree facing the State land.

People who go upon State lands are expected to abide by the rules made by the Forestry Reservation Commission. The Commissioner of Forestry is the President of this Commission and has direct charge of the reserves.

This land was brought by the State as a forest reserve for the production of timber, for the preservation of the water supply, to equalize the stream flow, and as a recreation ground for the people. The land, therefore, belongs to the people of the State as a whole. The developing and managing of this land should be of interest to every citizen of the State. It is the policy of the State to plant up all the vacant places found on the reserve and to do this it is necessary either to buy or raise young trees. Experience has taught

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that it is cheaper for the State to raise seedlings, and this is being done in the different forest nurseries, a small one being on this reserve.

Roads.

The roads on this reserve could be used as fire lines and for rapid communication from one end of the reserve to the other. These are nearly all grown shut, so that the expense of opening will be in excess of other roads which were opened a few years ago. I think that the sum of eight to ten dollars per mile will cover the expense of opening the roads eight to nine feet wide. Labor is very scarce and is worth twelve and one-half cents per hour. Two men should be able to open a mile of road in three days. In some cases when the brush is not so thick, a mile should be opened in less than three days. Some roads will take longer than three days per mile. The road from Sparks' to the Richie place, about one mile, should be opened in one day by two men, costing $2.50.

Beans Cove Road. This road is very much grown up, mostly with barren oak. It extends across the John J. Cessna (No. 12), the W. P. Scheel, and across the Jane Ketterman tracts, connecting with the main Beans Cove Road in the south end of the Ketterman tract. It also runs upon the Tate tract and connects with the road that runs to Sparks' place. The distance is about three to three and one-half miles. It would take from ten to twelve days to open it, costing $25.00 or more. It would protect our land from fire coming from Sweet Root Gap and offer a means of rapid communication with the southern end of the reserve and with Beans Cove.

The Richie Road extends from Sparks' place through the larger part of the Elizabeth Herring tract to the Richie place on the Andrew Mouir tracts, thence on across the Andrew Mouir tract, dividing us from the Mary Wiland tract. The first mile of this road could be opened for about $3.50. The rest would cost from $8 to $10. Total distance is from two to two and one-half miles. It would take from three to five days with two men.

A road runs across the western part of the Jacob Whetstone tract down on the Bastian and Mary Cegg tracts, a distance of from two and one-half to three miles and could be opened in from eight to ten days at a cost of about $30.00.

The Sparks' Road extends eastward from his place on the Elizabeth Herring tract, across the northwest corner of the Tate, across the eastern portion of Henry Whestone tract and part of the Thomas Brown to the Bedford Road. This road can be left for another year. The Bedford Road extends across the Thomas Brown. Also a road that runs along the top of the mountain from the Bedford

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Road extending across the Thomas and John Brown tracts can go for at least another year. These roads can be traced very well by the use of the forest maps now in existence.

These roads will give us a fairly good fire lane system. As soon as there is more money available for this work there are numerous other roads that should be open, but more for rapid communication than for fire lines.

Improvement Cutting.

On this reserve there are a few places that could be improved by thinning. The main thought is, will the improvement pay? Labor is scare and wages high. There is no sale for cord wood. The nearest railroad station (Lutestown, P. R. R.), is eight miles distant from the northern part of the reserve and twelve to thirteen miles from the southern part. In most cases the workmen have a walk of from three to seven miles to their homes. There is not enough timber in any one place to warrant fixing up roads, etc.

We could make a light thinning on about fifty acres situate on the ridge at Sparks', but we could get nothing but cord wood for which there is no sale. There are about ten to twelve M. feet of hemlock and birch in Sweet Root Gap that has reached its maturity, but a good road would have to be built into the Gap to get the lumber. This road would cost at least $500 and we would also have to repair two and one-half miles of other road, costing at least another $500. The timber that should be cut is much scattered throughout the hollows, so that it would cost at some places twice as much as the product is worth.

There is not enough timber for a lumberman to make a bid on it, else it would be advisable to sell it on the stump down to a certain diameter. The tract of fifty acres of mixed wood is about twenty-five to thirty years old and has much dead chestnut and pin oak on it about six inches in diameter. This would produce cord wood only. It would take at least $150.00 to $175.00 to make the thinning without getting any returns. There are a few old scattered pitch pine on the Henry Whetstone and the Jane Ketterman tracts that should be cut, but it would also cost more for lumbering than the timber would bring. We might be able to sell some of the old rock oak on the Hannah Whetstone for the bark. This would not cover more than five acres and would produce about twenty tons of bark.

Pulp Wood.

We have a small amount of cucumber and linden in Sweet Root Gap but it would not pay to get it out. The distance is about eleven miles to the railway station. Mr. F. Dell Everett has furnished a

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list of the species, specifications, and prices paid for the same, delivered at Lutestown station:

Specifications.

All wood must be peeled of bark, billets 5 feet long, pieces as small as 4 inches. Large pieces must be split. Decayed pieces must be cut out. One hundred and sixty cubic feet to the cord, delivered at the railroad.

Fir, poplar, cucumber, aspen, mixed, $6.00 per cord.

Maple, birch, beech, sugar, gum, elm, ash, sycamore, butternut, mixed, $4.80 per cord.

Jack pine or yellow pine, white pine, $4.60 per cord.

The cost to haul eleven miles would be from $4.00 to $5.00 per cord.

Planting Areas.

The fields on this reserve are for the most part slightly hilly, in most cases sandy. Some places have slate covered with a heavy sod and a few scattered pitch pines.

Field number one, covers from eight to ten acres and is located on the Elizabeth Herring tracts. Sandy soil, very hilly. On the side of a ridge in these fields Mr. Sparks, the ranger, has his house and nursery. It consists of a number of open tracts divided from each other by trees.

Number two, the Richie Fields, consist of about ten acres located on the Andrew Mouir tract. Soil is sandy with slate. Some portions are very rocky. It has a northwest slope in general and is at the foot of Martin Hill. The area is divided into two fields connected by a road. One field contains the orchard and garden, the other a few barren oaks and pitch pines.

Number three. This field is located along the side of Evitts Mountain on the northwest end of the Mouir tract, consists of nearly four acres slaty soil, and contains a few pitch pines. It has a slope to the southeast.

Number four. This field is the east side of the Elizabeth Whetstone tract and consists of about one and one-half acres known as the Shorty Patch. Sandy soil, north slope, with a few small trees.

Number five. This field is situate in Ressler Hollow and contains about ten to fifteen acres, on the Hannah Whetstone tract.

Nursery.

The nursery described more fully in the Plan for Management, is located in an old field situate near Mr. Sparks' house on the Elizabeth Herring tract on slaty soil. One portion of it has a north-

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west slope and the remainder has a southeast slope with a small hollow between which drains to the eastward. The seedlings were a failure because of the lack of covering last winter and this spring they were lifted out by the frost. Most of them were killed. A few lived, but did not do very well this summer. We will fix up one bed, transplant and cover those that remain, and leave them in the nursery for another year.

Fire Season.

An additional ranger should be appointed for Beans Cove during fire season. A man in Beans Cove can watch the Jane Ketternan, Agnes Roof, Jacob Whetstone, Christian Whetstone, Bastian and Mary Cegg tracts, also the Howard Cessna and J. C. Donahoe, which are separated from the main body of our land and situate along the summit of Tussey Mountain.

REPORT ON CONDITIONS IN THE TROUGH CREEK FOREST RESERVE, HUNTINGDON COUNTY.

B. FRANK HEINTZLEMAN, Forester.

The Trough Creek Forest Reserve consists of two distinct tracts of land lying in Huntingdon county, aggregating about six thoussand two hundred acres.

The large tract, locally known as the Kendig tract, contains about 4,800 acres, and the smaller tract, known as the Brumbaugh tract, contains about 1,400 acres.

The Kendig Tract.

This division of the reserve lies on Terrace Mountain in Cass, Union, and Penn townships. The ridges extend in a northeastly and southwesterly direction having an altitude of probably fifteen hundred feet above the sea level.

The eastern slope of this ridge contains the greater part of the tract. It is very gradual and has many benches or terraces from which it derives its name.

Not many large rocks are found on the surface of the ground on this slope. The soil is of a sandy nature, with a good humus and at a depth of about a foot, a subsoil of tight clay.

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Near the top of the ridge the land is generally more nearly level. In some places the soil is wet. The west slope of the ridges is very steep, rocky, with little soil except in a few places where a good sand soil is found.

The roads on the east slope and top of the ridges are numerous and well opened. The west slope has only a few old bark slides as it is too steep and rocky. A good township road runs over the ridge through the tract.

This land was lumbered over a second time about six years ago. Almost everything then merchantable was cut. For this reason the large trees now standing are few and isolated, but they have long clean boles showing that they once grew in dense stands. The whole tract has a lumbered appearance.

Cleared Land.

About six acres of land have been cleared and used for saw mill sets. This is the only cleared land. These clearings should be planted at once, preferably with white pine. The seedlings could be gathered from adjacent lands for probably a small sum of money. Some of the clearings are at present growing up with pitch pine.

Nursery Site.

The most suitable site for a nursery exists on one of these clearings. It is situate on the east border of the reserve on the township road. The land slopes toward the northeast, is fairly well drained, and conveniently located near water. A small stream flows about fifty feet from the site. The soil is loamy, underlaid at a depth of about a foot with a tight clay. Years ago it was used for a potato patch.

The Forest.

The forest may be divided, according to species found, into pitch pine land and hard wood land.

Pitch Pine Land.

Pitch pine land occupies the greater part of the eastern slope and top of the ridge. The principal species found in mixture are pitch pine, chestnut, rock oak, red oak, and white oak.

The pitch pine forms probably one-half of the crop. The trees are generally straight, healthy, seldom forked, and tall for their diameter. Very few large trees are found but many trees too small to cut when the area was lumbered, are now between the sizes of ten to sixteen inches breast high. In some places pines one to four inches in diameter are dense. But as a rule the pines are isolated.

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The trees of merchantable size are not plentiful enough to market profitably. Chestnut ranks next in number to pitch pine and forms probably one-third of the mixture. Many large over-mature trees are found. Many are between six and ten inches in diameter, and most have been damaged at the butt by fire. Almost all the chestnut is coppice and is growing well although many side branches are developing.

Rock and red oak are plentiful and in good condition, but mostly small. White oak is not plentiful, is small, but grows well. This stand varies greatly in density and is seldom well stocked. According to a rough estimate of this type of land about 85 trees over five inches in diameter, breast high, are found on the acre. Of this amount 43 are pine, the remainder other species. The undergrowth is very dense, seldom leaving the ground exposed, and consists mostly of scrub oak. Chestnut and oak sprouts ten to fifteen feet high are found everywhere growing vigorously. Black locust sprouts are also plentiful. Pitch pine seedlings are abundant on all small openings and along open roads, but these openings are not numerous.

Hardwood Land.

The hardwood consists of land on the west slope of the ridges on White Oak Flat, in Garnim, Dry, and Short Hollows on the east slope of the ridge. These hollows are small ravines through which little streams flow from springs.

The hardwood land occupies one-fourth of the area of the tract. The west slope supplies a good growth of chestnut, red oak, locust, hickory, and rock oak.

The growth is well shaded and reproduction not good. Many over-mature chestnuts and red oak are found. Chestnut forms probably one-half of the stand and is of good height, well cleaned.

Locust forms a good percentage of the mixture. The trees are mostly young, tall, and straight. Hickory is plentiful near the top on the ridge and grows in groups, at some places almost among pine stands. Trees are generally under eight inches in diameter, tall and well formed. The rock oak was cut out a few years ago for the bark, and is not abundant.

White Oak Flat and Garnim, Dry, and Short Hollows have a moist somewhat swampy soil and large rocks. Much of the timber of these areas is large. The ground is shaded completely and there is little reproduction. Over-mature black gum and white oak are abundant. Many large red oaks and red maples are also found. The trees stand close together and are well formed. Of the younger timber, white oak is the most abundant and is the most important.

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It may be the ruling species in a few years if properly handled. Red oak, rock oak, and maple, and along the ridges of the hollows, chestnut, are very abundant. Some species occasionally found are white ash, tulip poplar, cucumber, and hickory.

Brumbaugh Tract.

This land lies on the same ridge and partly on Short Mountain just southwest of the Kendig tract, and is separated from it by a narrow strip of land called the Grove land. As a rule the land is steep and rocky, in some places supporting a poor growth. A good public road runs through the tract. An open area of about eight acres exists. This is coming up to pitch and white pine, mostly the former.

Pitch pine occupies the upper slopes of the ridges and corresponds with the pitch pine land described before. The remainder of the tract supports a hardwood mixture of chestnut, red, pin, and white oak. It is similar to the west slope of the ridges described before.

Fires.

Since the State has acquired this land only a few small forest fires have occurred. Because of this, sprouts from chestnut and the oaks are becoming large and dense, and small pitch pine seedings are appearing.

Improvment Cuttings.

About the only improvement cuttings needed badly is the removal of mature and over mature trees which are so plentiful, especially on the hardwood lands. As this cannot be done at a profit at all, or else a very small one, improvement cutting will have to be dispensed with, at least for the present.

REPORT OF CONDITIONS EXISTING ON STATE FOREST LAND IN THE NORTHEASTERN PART OF MIFFLIN COUNTY, PENNSYLVANIA.

JAMES E. McNEAL, Forester.

The tract in question lies in the northeastern part of Mifflin county, Pennsylvania. It consists of three valleys, Havice, Treaster, and Lancaster. Havice is the most northern valley, Treaster valley is in the middle, and Lancaster valley lies to the south of the

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other two. The general direction of the valleys and ridges is northeast and southwest.

Topography, Geologic Formation, and Soil.

All three said valleys are traversed by good sized streams. The Havice and Treaster valley streams run into sinks near the southwestern end of their respective valleys, that is, they flow into cavities in limestone formations. All three streams finally flow into Honey Creek. The topography of the country is rough except on the southwest end of the ridges between Havice and Treaster valleys where there is a large flat.

The most important rock is sandstone; however, there is a great deal of slate which crops out on areas scattered all through the tract. On the top and upper slopes of the mountains there is very little soil, being stony and bowlder strewn. In the lower slopes and in the valleys the soil is comparatively thick and is sandy loam or slate soil.

Clearings and Settlements.

There are several small clearings scattered over the tract which were originally used for farms. There are few people living in the immediate vicinity of the tract and only two families living on the tract. One family lives in Treaster valley on a farm owned by the State, and another lives on a farm in Lancaster valley, also owned by the State.

Types of Forest.

Generally speaking, there are three distinct types of forest existing on the tract.

First. Hemlock bottom.

Second. Oak and chestnut slopes.

Third. Yellow pine ridges.

Hemlock Bottom.

The hemlock bottom land is most prominent in the southwest ends of the valleys and dies out as the heads of the valleys are approached. The most important species growing in mixture with the hemlock are white pine, white oak, red oak, chestnut, and a few red maple.

The floor of the forest in the bottom is as a rule clean with the exception of scattered areas of rhododendron and laurel.

Reproduction under the rhododendron is entirely wanting, but on the clean floor the reproduction is exceptionally good. Good growth has been made by the older stuff, which is first class.

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Oak and Chestnut Slopes.

The most important species in mixture on the slopes with the chestnut are white oak, red oak, rock oak, and hemlock on the lower slopes. The underbrush is mostly huckleberry and sweet fern. The regeneration is good and the older stuff is in good condition, but in many places is dense and needs thinning.

Yellow Pine Ridges.

Yellow pine is most important on the ridges but there are a few white oaks, rock oaks, and chestnuts growing with it in mixture.

Lumbering.

The whole tract has been lumbered over by different people since 1885. Strong improvement, which is the flat on the mountain between Havice and Treaster valleys, was cut by Duncan about ten years ago and was burned over about a year after it was cut. The growth is from ten to twenty feet high and is composed mostly of scrub oak. There is, however, a number of white oak and chestnuts that seem to be doing well. There is a number of small patches of aspen also growing in this flat.

The north hill on the side of Strong Improvement was cut about ten years ago and burned about three years ago. The lower Treaster tract, that is the southwest end of Treaster valley, was cut by Whitmer and Steel about twelve years ago and hasn't been burned over since. The growth of hemlock and white pine is exceptionally fine on this area.

The upper end of Treaster valley was cut by Lichtenwalter about fourteen years ago and was burned about four years ago. This area seems to have been lumbered clean as there are no good sized trees standing and the trees which are standing are scattered. There is much alder and laurel undergrowth which is very thick.

Beatty Knob, which was cut out by Reichley nine years ago, has had no fire on it. The tract is on the ridge between Treaster and Lancaster valleys and the growth is not worth much because it was lumbered clean and a growth of scrub oak has sprung up. There are a few chestnut trees.

A tract in Lancaster valley was cut about eight years ago and no fires have been there since.

Bear Valley, a small valley in the mountain between Treaster Valley and Lancaster Valley, was left untouched when they lumbered in that district. There is a growth of hemlock and white pine there, large and in good condition.

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Market and Transportation Facilities.

There are several saw mills in the immediate vicinity of the tract at present which supply the people with fire wood in the form of slabs and edging, at small cost. Because of this and the small number of people which live near the tract there is positively no market for this kind of product from the State's land.

The roads, especially in Havice and Treaster Valleys, are in bad shape. They are full of large stones. Places which were corduroyed at one time are worn out. Bridges are down in the upper end of the Treaster Valley and the road is grown shut with alder.

The Lancaster Valley road is a public road and is kept in comparatively good condition. There are very few trails on the tract, and those that exist are hard to travel even on horse back.

There are several areas that should be planted. On the farm in Havice Valley there is at present a scattered regeneration of white pine that seems to do well. Black walnut also seems to do well. The soil is slate and hasn't been farmed for some time. The farm in Treaster Valley is also slate. Black walnut does well here, too. In Lancaster Valley there are several scattered abandoned fields in the vicinity of the farm owned by the State. These fields, besides a portion of the farm, should also be planted, as they are standing idle and no return is promised from them. The fields are on the lower slopes of Jacks mountains where white pine should grow.

Conclusion.

On account of not being able to obtain a revenue from the land at present, it is advisable to keep the fires out and let the trees grow into lumber. There should be a ranger stationed on the tract to look after it. It would not pay to fix the roads up at present because of the great amount of work which would have to be put on them and the little use there would be for them after they are fixed. The roads in the valleys, from the viewpoint of fire protection, are not needed because of the large streams which flow down through them.

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A WORKING PLAN FOR THE PENNSYLVANIA STATE FOREST RESERVE IN COLERAIN, SOUTHAMPTON, AND CUMBERLAND VALLEY TOWNSHIPS, BEDFORD COUNTY, PA.

WILLIAM L. BYERS, Forester.

This can hardly be called a Forest Working Plan owing to the present condition of the reserve. It should better be called, A Plan for the Management of This Reserve for not Over Twenty Years. The protection of the forest and of the mountain region of which this reserve forms a part is not only important for their prospective value as a source of timber supply, but also for the effect in regulation of stream flow. That the streams of the State may be constantly and evenly fed, it is essential that the water sheds should be protected by forest cover. That breaks the force of falling rain and prevents erosion, while the humus or the forest floor acts as a natural reservoir. The humus by checking the run off retains some water which would otherwise run off rapidly. This prevents freshets and keeps the brooks and streams filled during times of drought. Fire is the greatest enemy of the forests. It not only destroys the standing timber and the young growth, but it burns the leaf mould or humus which has the power of retaining the water. In making cuttings on the slope of mountains this should always be remembered. The timber should not all be cut at the same time, Some trees should be taken out and sufficient number be left to prevent erosion. While there are no streams of any size on the reserve, yet the streams that rise on this reserve are the beginning of the larger ones that flow through the valleys. Anything that would cause the streams to run dry or even to become smaller during the drought season would have the same effect on the larger streams into which the streams from this reserve flow.

The greatest problem that we have to deal with in connection with forestry in this State is fire. This I believe causes more damage to the forest than any other agency. The lumberman takes from the forest only those trees that can profitably be made into lumber. These are in most cases trees that are fifty years old or older. He leaves the young growth. If fire were kept out, this would soon become of size to bear fruit, from which other trees would spring. Fire kills the young growth. We will have to pro-

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tect our forest lands from fire. The people of this State are being educated as to the damages resulting from fires in the forest. They are becoming more careful when in the forest in regard to the use of fire. The necessity for opening roads and trails on the reserve so as to have a place from which to start back fires is apparent, as also ways by which we can get to a fire quickly. For these reasons roads on this reserve should be speedily opened. In the fall of each year the roads that have been cut out should be cleared of brush and one or more other roads opened. The most important roads should be cut out first, the less important later. The cost of the opening of these roads should not exceed ten dollars per mile, and the clearing out thereafter should not exceed three dollars per mile.

Situation of the Tracts.

The tracts, three in number, are situate in Colerain, Southampton, and Cumberland Valley townships, Bedford county, Pennsylvania. One tract is located about one mile in a southwesterly direction from the main body of land. Another tract is south of the main body about twenty-five rods. They do not differ in soil, topography or forest to any great extent.

Desire of the Owner.

The State desires to hold this land for the protection of stream flow in this part of the Commonwealth and to produce timber so as to be able, after a suitable time has elapsed to cut a definite amount each year, and to cut this so that at no time will any of the land be cut entirely clean. It is also the desire to produce the greatest possible revenue in the least time with the least expense. The State will protect this land from fire, and plant up the open fields as soon as convenient with the most desirable species of trees.

The Object of the Working Plan.

The object of this working plan is to show a scheme by which these results can best be obtained. It is to show how the land can be cut over, what parts should be subjected to improvement cutting, what tract should be planted up, and what fire lanes, roads, and trails should be opened.

Character of Survey Work Done.

Because the management of this reserve should not be intense for at least twenty years, there will not be any yield, volume, or value tables made at this time. Notes will be prepared on the different roads on and near the reserve. The survey work done to

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date was mostly with a pocket compass. The map is taken from the old surveys. The management of this reserve as stated, should not be intense because of the lack of merchantable timber now found. The only cutting allowable should be that to improve the young timber. These lands have been surveyed at different times by different surveyors. In some cases the corners were not found and the surveyors made corners of their own. Later the older corners were located. We therefore have two corners occasionally, separated by a distance of a few rods. This causes tract to overlap tract.

Main Tract.

This tract extends from the northern side of the Bedford road (leading from Bedford to Chaneysville through the Rainsburg Gap in the Tussey mountains) to south of the road that extends from Chaneysville to Beans Cove, and north of the road from Beans Cove to Centerville. It extends from the east side of Evitts mountain, contains about 6,200 acres, and includes the greater part of Martin Hill.

Tract No. 2.

This tract lies south of the main tract about one mile and is located on Tussey mountain. It contains about 700 acres.

Tract No. 3.

This tract lies south of the main tract and northwest of tract No. 2. It is located on ridges south of Martin Hill and contains about 200 acres.

Streams.

The streams on Nos. 2 and 3, and on the southern end of the main tract, flow south into Flintstone Creek. Streams on the northern end of the main tract flow into Cove Creek. On the eastern end of the main tract they flow into Town Creek, and on the western side into Evitts Creek in Cumberland Valley township.

Topography.

The topographic features do not vary to any great extent. The drainage is in the four directions with Martin Hill as the divide. The ridges are not high and are generally broad, while the mountains are high and not very broad.

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Soil.

The soil for the most part is sandy. In some places it is pure sand, while in others it consists of a small amount of sand with large quantities of sand stone. The pure sand is found mostly on the southeastern part of the main tract and on tract number two. The sand soil covered with large sand stones is found in the central and southern part of the main tract and on tract number three. Sand mixed with slate is found in the northwestern part of the main tract. The subsoil is of gravel. The hollows are mostly in sand stone, very rocky. In some portions of the main tract, as in the northern portion, there are pure slate outcrops. Limestone outcrops in Friend's Cove, about one and one-half miles from the reserve.

The Forest.

Although most of this land was warranted to settlers about 1794, yet to-day there is a very small amount of cleared land found on the reserve. There is little land included in the State holdings that would do for agriculture. I should say at least not more than one per cent. The soil is poor and not fit for anything but the growing of trees.

Lumbering.

There has been some lumbering on this land. Here and there is found a place where a small quantity of lumber was taken off for local use. The timber has mostly been used for the bark which was produced, especially rock oak bark. There was a tannery located a short distance above Rainsburg. The rock oak was cut and peeled, the logs left in the woods to decay, the bark hauled to the tannery. The land was then used as a public range for grazing cattle and sheep. Fire burned over much of this land every year, destroying young growth and hindering good reproduction. Fire has not burned over this land within three or four years, and as a result, the reproduction is now, in most localities, very good.

Types of Forest.

We can distinguish at least three different types of forest growth on this reserve.

First. The "hollow" type, where the trees are from sixty to seventy years old, mostly white oak, yellow poplar, chestnut, and in some cases a few hemlocks are found. The young growth consists of chestnut, red oak, hemlock, and white pine ranging from ten to

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forty years old. These stands are with one or two exceptions, not very dense and cover about three-sixteeth of the reserve. There are also found in these stands young hickory, cucumber, and birch, but not in sufficient number to be taken account of.

Second. This type is composed mostly of chestnut and rock oak from twenty to thirty-five years old. There are also found a few white oak, hickory, and red oak, both old and young. This type is found on the slopes of the mountains and on the ridges and covers about one-half of the reserve. The young growth consists of chestnut and rock oak five to ten years old. On parts of the reserve this type is dense while on other parts it is open.

Third. This type is represented by very dense barren oak with a few scattered yellow pines twenty-five to sixty years old, and covers about five-sixteenths of the reserve. The types run into each other, as for exaxmple, we find type one extending into type three, as also type two extending into types one and three.

Cleared Lands.

This represents about one per cent. of this reserve. The cleared land was used for farms, but for the last few years has been abandoned. It is becoming gradually covered with yellow pine and sumac. See further discussion on cleared land hereinbelow.

Damage to the forest.

Fire is the only cause of damage to this reserve. Grazing was until four years ago another agency that caused damage to the reserve. Insects do not cause enough to be worth mentioning. Grazing if done in excess is harmful. The cattle eat the leaves off the young seedlings, and trample them into the arth. If grazing is restricted to a limited number of cattle not much harm results. Cattle in some ways at present are a benefit to the reserve by keeping open the numerous paths through the forest, but the damage done by the cattle is in excess of the benefit derived therefrom. Fire is the natural enemy of the forest. The damage wrought by fire consists of impoverishment of the soil and a lessening of timber growth thereby preventing the germination of tree seeds, the gradual destruction of the large trees, and opens the way for erosion of soil with resulting floods and consequential damage to valleys and low lands. Fire also by burning a tree reduces the grade of lumber sawed from it. To improve the grazing, those who own cattle often set fire to fields. This caused great damage to the surrounding for-

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est, because in most cases the fire was not stopped when it had burned over the fields, but was left to go on into the forest.

Roads.

The roads that are opened on this reserve should be cleaned each fall, just before the fall fire season. We should open the roads as soon as possible and just as many as possible until we have a system of roads that extends all over the reserve. The reserve should be divided into blocks of about five hundred acres each, and have roads running around the blocks; also have paths running through the blocks at intervals. These roads need not be over twelve feet wide, and the paths not over three or four feet wide. Such a system of roads and trails would permit the speedy stoppage of fires. At the same time these roads, if kept open, would be valuable for use in hauling out lumber and wood.

When these roads are opened, because of the sandy nature of the soil, the leaves and mulch should in no case be cleared off. If left on the roads they prevent erosion. When the time comes to do any hauling on these roads, they can be put into suitable condition at less expense than if washed out by the rains. The road that leads from the Schafer place up to the Blankly or to the Richie place should be repaired at once. This road runs up over the end of the ridge, and is, therefore, steep and short; but it would give us a road from Friend's Cove into the reserve, and would also be the shortest route from Bedford and vicinity to the reserve. This road could be sufficiently well repaired for fifty dollars or less. The road that was cut open for use as a fire line to the Bean's Cove road should also be repaired for driving as soon as it is possible to do so. To do this it will be necessary to find an easier grade up the side of the mountain, as the present grade is thirty per cent. and in some places greater. The cost, therefore, would be greater than for the other road. This would give direct communication from Friend's Cove to Bean's Cove, would be a benefit to the surrounding community, and would help the working of the reserve. It is necessary for the proper management of this reserve that we have means of rapid communication from one part to another.

If at present one should wish to drive from the northern to the southern part of the reserve, it would be necessary to go down through Rainsburg Gap within a mile of Chaneysville, thence back across Tussey Mountain, a drive of from eight to ten miles, while a road made along the fire line running to Bean's Cove Road would decrease the distance to five or six miles. In case of fire the difference in mileage would make a great difference in the cost of putting

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the fire out. The quicker a fire can be reached the better, both from the viewpoint of expense and damage to the forest.

Lumbering of the Present Crop.

At the present time a cutting could not be made at a profit. There is no sale for cord wood. In this country nearly every farmer has his own wood lot from which he may draw his wood supply. Other people who live near the reserve use, in nearly all cases, slab wood from a few saw mills that are still found in the county. In most cases they get it for taking it away from the mill. Under these conditions there is no sale for cord wood. Pulp wood is sold in this county for a fair price, but considering the hauling to the railroad which is in some cases nine miles, and in others as much as fifteen miles, the sale of this kind of wood is unprofitable. Locust wood is bought for certain purposes but here again the hauling of it is such that this business cannot be carried on at profit.

The locust on this reserve is scattered throughout the northern part, making the cost of cutting and collecting unusually great. The large timber found in the hollows, although in some places much scattered, could probably be sold at a profit. This timber should be cut out soon so as to give the young timber a chance. It should be cut only after competitive bidding and sold on the stump. The buyer should give a bond, to be forfeited in case he is found needlessly destroying young growth or cutting trees below the diameter limit. The limit should not be lower than twelve inches and better fourteen inches. Selling the timber on the stump would save the State the cost of rebuilding the roads to get the lumber out of these hollows. Because the management of this reserve will not (or should not) be intense for the period covered by this plan, the reserve will not be divided into small compartments or working sections. We should have only the three divisions at the present time, namely, the three that are represented by the different types of forest growth although they will be very irregular as to size.

Compartments.

Compartment number one will include all the hollows that are found on this land and will take in all that is covered by type number one. Compartment number two will take in all the land that is covered by type number two, including the slopes of the mountains, the slopes and tops of the ridges, and part of the top of Evitts mountain. This compartment will not be continuous in area. Type number three cuts into a portion of it, separating it into two areas.

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Compartment number three will include all the land that is covered by type number three.

Compartment number one covers about 1,350 acres.

Compartment number two covers about 3,650 acres.

Compartment number three covers about 2,250 acres.

These different compartments will be shown on the reserve map when completed.

The Working of Compartments.

Compartment number one contains nearly all of the merchantable timber to be found at present on this reserve. In some places this timber is rather dense, but generally much scattered. To get the timber out of the hollows much rebuilding of roads must be done. All this timber over fourteen inches in diameter should be cut within the coming five years so as to give young growth in these hollows a chance to grow faster. It should be sold on the stump for the reason already named.

To cut this timber in five years would require cutting over at least 270 acres per year. The hollows for the most part are rocky and will make the cost of rebuilding higher than it otherwise would be. The rocks are of sandstone with ganister mixed in. This compartment could then be left for at least fifteen years, when again it would be cut over down to the diameter limit, raising the diameter limit at every cutting. Thereafter a certain amount might be cut each year. As the management becomes more intense the compartment will have to be divided into smaller portions for ease of management.

Compartment number two. This compartment will take in all of the young growth on the reserve where chestnut and rock oak are the predominating species. It contains a small amount of scattered trees from which lumber could be cut. It might be well to have this compartment divided into twenty different portions each consisting of about 183 acres, one of these sections to be cut over every year, thus taking twenty years to make the cutting over the compartment. The result would be cord wood only and the cutting should be done so as to improve the remaining stand. All old and decayed trees should be cut out. On the slopes the cutting should be light so as to prevent erosion. In some of the most exposed places it would be better to make a very light thinning and then return after several years and make another thinning, to prevent erosion.

An improvement cutting is made to improve the trees left standing by giving them more room and light, thus causing them to grow faster and to produce timber in greater quantity. Although improvement cutting lessens the number of trees to the acre it gives

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more room to the remaining trees, causing more rapid growth and no loss of increment on the tract as a whole. But we must not overlook the fast that if an improvement cutting is made too heavy, it opens the land up to the action of water, causing erosion, and also to the wind which sometimes causes wind falls. Both these reduce the productiveness of the land. Therefore, in making such a cutting, care must be taken not to cut too heavily. This compartment has few roads. Some of the wood would have to be sledded down the sides of the mountains. The soil for the most part is sandy with a few sandstones. The sides of the mountains and ridges do not have much soil but are covered with sandstone. The humus in the compartment and compartment number one is rather thick, the ground not having been burned over for several years.

Compartment number three. This contains 2,250 acres principally barren oak thickets with young chestnut and rock oak about five years old, and is very dense. It also contains a few scattered pitch pines twenty-five to sixty years old, many of which are diseased, with the larger part dead or dying. These trees should be cut out over the entire tract as soon as it can be done at a profit.

When protected from fire the chestnut and the rock oak will in time grow up and shade out the scrub oak. It would be best not to divide this cutting of the yellow pine into any time lenghts, but it should be removed as soon as possible so as to get this old pitch pine off the land and give the younger growth a chance to crowd out the scrub oak.

Transportation.

Aside from the question of fire, transportation is the hardest problem which we will have to deal with on this reserve. The country around the reserve is not thickly populated. There are no railroads that run through this county anywhere near the reserve. The Baltimore and Ohio runs through Cumberland sixteen miles below the lower end of the reserve. A branch of the Pennsylvania Railroad runs from Cumberland, Maryland, to Mount Dallas, Pennsylvania, and there connects with the Huntingdon and Broad Top. The nearest station to the northern end of the reserve is at Lutzville, eight miles from Rainesburg. From the northern end of the reserve is a down grade to Lutzville, but the roads are sandy and the hauling hard. This would be the best way to get any timber out of the northern end. From the southern end it would be best to haul to Cumberland. From the eastern side of the reserve it would be best to haul it to Everett, on the H. & B. T. R. R., a distance of from sixteen to eighteen miles. From the western end of the reserve it would be best to haul down the Bedford Cumberland Valley to Bedford station on the Pennsylvania Railroad.

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The great distance that the product would have to be hauled will cut the profits. The most common method of hauling lumber in this country is with a four horse team carrying about 1,400 feet B. M., although traction engines are sometimes used, these hauling from 2,500 to 3,000 feet B. M. The public sentiment of this county is against the hauling of lumber with engines for the reason that they cut the roads badly and cause the county a great deal of expense for road repair. The cost of hauling a load of lumber from one mile below Chaneysville to Everett is from eight to ten dollars, as it takes two days to make the trip. Mr. James Barndollar of Everett owns lumber below Chaneysville and is having it hauled to Everett. His expense includes the repairs of the wagons, eight head of horses to feed, two drivers to pay for two days, and they haul from 2,400 to 2,800 B. M. at a load. To Lutzville from the northern end of the reserve a trip can be made down and back in a day. The streams found on this reserve are not large enough to float timber, although by the aid of splash dams we may be able to float logs in a few of the larger streams, as the Bear Gap Run, Pigeon Roost, and Sweet Root Runs. Outside of these, the lumber will have to be hauled on wagons.

Marking of the Trees.

All the timber to be cut should first be marked, and, in the case of trees sold on the stump, each tree should be marked below the point where the tree is to be cut off. Trees should be blazed with an axe and then some mark stamped on with a hammer made for that purpose, so that in case the lumberman cuts a tree that was not marked it can be easily detected.

Rules for Cutting.

All trees over a certain diameter should be cut. All defective trees of any diameter, if they can be taken out at a profit, should be cut. Where young timber is scattered, no trees shall be cut for use as skids, etc., but these should be taken from the young growth where it is more dense. Care should be taken in felling large trees to do as little damage to the young growth as possible. The logs should be cut out of a tree as far up toward the crown as profitable. The crowns should be lopped flat to the ground and removed from the trees that are left standing.

Distance of towns from the Reserve.

Rainsburg is about two miles from the northern end of the reserve. Chaneysville is about two and one-half miles from the east-

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ern side of the reserve. Bean's Cove, a settlement, is about one and one-half miles south of the reserve. Bedford, fourteen miles northwest of the reserve. Cumberland is sixteen miles south of the reserve. Centerville is about seven miles southwest of the reserve, and Flintstone, six miles southeast of the reserve.

Labor.

Labor is worth twelve and one-half to fifteen cents per hour.

The main difficulty of the labor question on this reserve, is the distance that any of the towns is situate from the center of the reserve. Any work that would be done on the center of the reserve would require temporary houses for the use of the laboring men, as their houses would be too far away for them to walk every morning and evening. One of our rangers who has had some work done on the reserve says that all the men he had he paid seventy-five cents per day with board and lodging. This is not a satisfactory method for the reason that some days it is impossible for the men to work. It would be better for the State when it has any work done in the central part of the reserve, to erect temporary quarters for the men and pay them so much per hour allowing them to board themselves. They would have to be allowed the use of dead wood on the reserve for fuel.

Cleared Lands.

There is not much cleared land found on this reserve. In all it would hardly amount to one per cent. of the area. This land was formerly used for agriculture, but has since become too poor for that purpose. The soil is sandy. These old fields should be planted up as soon as possible. It would be better to have a planting plan made for this land before it is planted up. Some of these old fields slope to the north while others slope to the south and east; therefore, it would be better to do the planting with the aid of a planting plan.

Nursery.

There is very little land found on this reserve that is suitable for tree culture. No more seeds should be planted for the present than will produce enough trees to supply this reserve. It would be well to plant a certain quantity of tree seeds each year on every reserve. In case of failure, the required number could be had from one of the larger nurseries. The nursery at Greenwood, Huntingdon county, would be best to draw on for this reserve. The nursery here is also

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some distance away from the labor supply. This would be a great drawback to a large nursery, as also would its distance from the railroad. About five pounds of white pine seed is all that would be advisable to plant, besides a small quantity of other seeds. Five pounds of white pine, if planted this coming spring of 1908, should yield when two years old (fifty per cent. germination) at least sixty to seventy thousand seedlings (counting for loss after the seedlings appear above ground.) Then in the spring of 1909, five pounds more could be planted and every spring thereafter. This should yield from sixty to seventy thousand two year old seedlings to plant every spring. In addition there would be small quantities of such as hickory, white oak, red oak, tulip poplar, etc.

Reserved Lands.

Mr. Howard Cessna from whom some of the tracts were bought, has reserved in the deed of September 27, 1902, 116 acres and 123 perches within the eastern part of the reserve located along the Sweet Root Gap. This piece of land starts at Sweet Root stream, extends up the end of the Tussey Mountain, and is reserved for the ganister that the sand rock contains.

Public Roads.

There are two public roads crossing this reserve. One crosses the northern part through the Rainsburg Gap and runs through Bedford to Chaneysville. The other crosses Tussey Mountain and leads from Chaneysville to Bean's Cove. Both of these roads are very steep in places and both are rough. The road to Bean's Cove is made of sand and sandstone and washes out after every heavy rain. It is on State land for a distance of about three-fourths of a mile. The other road extends about sixty rods on State land. The roadbed is made up of sand, a light mixture of clay and sandstone. This road, although very steep, does not wash so badly as the Bean's Cove Road. The part of this road on State land is kept in repair by Colerain township. The Bean's Cove Road is repaired by Southampton township.

Soil of Surrounding Country.

The soil is mostly sand with a subsoil of gravel. Along the sides of the ridges next to the valleys slate is found. In Friend's Cove limestone is found which crops out at a distance of about one and one-half miles from the northern end of the reserve.

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The Reserve Employees.

The plan of the State is to have a ranger for about every five thousand acres of land. At present we have 7,300 acres of land with one ranger. There are also about 1,500 acres lying to the south and not included in this plan for the reason that lumbering is still being carried on. However, when the State comes into full possession it will have here about 9,000 acres. Then another ranger should be appointed to take care of the lower tract and a portion of the southern end of the present reserve now in possession. When a ranger is appointed for this southern tract he should be one who lives as near to it as it is possible to secure one.

History of the Reserve.

The better portion of this land was deeded by the State about 1794. In most cases the warrants call for four hundred acres with an allowance of six per cent. of roads. There were a few farms cleared by the earlier settlers in different parts of the tract.

Three of them are located on State land. One is known as the Wertz place, another the Blankly place, and a small one is known as the Shorty Ressler place. All of these have long since been abandoned, the last about 1889. These farms were located on flats at the foot of Martin Hill. The ground being sandy, it was not long after the forest growth was cleared off that the land became improved. Mr. Cessna of Rainsburg, owned a small tannery and produced bark for the tannery from this land. In 1880 Mr. Cessna built a large tannery and obtained control of most of this land. From 1880 to about 1899 or 1900 the destruction of the timber on this land was in full force. Rock oaks were cut and peeled and the logs left in the woods to decay. The tannery was closed about the year 1900. There was not much done with the land until it was sold to the State in the three different lots, the first by Mr. Howard Cessna, September 27, 1902, about 5,300 acres. The second lot January 9, 1903, by Mr. Howard Cessna, about 1,100 acres. The third by Mr. Walter Cessna, February 7, 1905, about 1,280 acres.

In 1903, Mr. J. H. Sparks was appointed forest ranger. At that time he lived at Chaneysville, but has since removed to Clearville. In the spring of 1904 he built a small house on the Blankly place and stays there through the week, going home over Sundays. A small house of about two rooms down stairs and one or two rooms upstairs should be built at this place using the shanty there at present at a storage house for tools and other property.

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The principal species of trees found on the reserve are:

Castanea dentata, American chestnut.
Quercus prinus, rock oak or chestnut oak.
Quercus rubra, red oak.
Quercus alba, white oak.
Tsuga canadensis, hemlock.
Robinia pseudacacia, black locust.
Pinus rigida, pitch pine.
Magnolia acuminata, cucumber.
Liriodendron tulipifera, tulip tree or yellow poplar.
Pinus strobus, white pine.
Quercus palustris, pin oak.
Quercus nana, scrub oak.
Hicoria glabra, hickory.
Juglans cinerea, white walnut, butternut.

THE BEDFORD COUNTY RESERVE NURSERY, OCTOBER, 1907.

WILLIAM L. BYERS, Forester.

The nursery of the reserve in Bedford county is located at a height of about 1,500 feet above the sea level, on an old vacant field that was used for farming in years gone by, but for the last few years has not been used at all. It is from sixteen to seventeen miles from the town of Bedford, and twelve miles from Lutzville, the nearest railroad station. Owing to the distance of the railroad, even if we were able to find ground that is suitable for tree culture, I would not advise the making of a large nursery. The field where this nursery is located is in a small hollow. Some of the beds are along the side of the hill on each side of the hollow, while some of them are in the hollow. There are about seven beds made up, all exceed one hundred feet in length, and were about seven feet wide, slightly raised in the center, and sloping down to the sides of the beds. Between each two beds is a path one foot wide. The soil is sandy with a gravel subsoil and stony. The slope of the beds was not quite right as the water ran off rapidly. The trees had to send their roots deep into the soil for water making it hard to transplant them. A few of the white pines had roots six to eight inches long. There is no way to irrigate except by hauling water.

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Last fall seedlings were not covered and when the frost came out of the ground the upheaval of the soil lifted the plants, exposing their roots. This caused the death of a number of seedlings. In transplanting the few that remained many were found that were uplifted, roots exposed, yellow, and the top bud black. These were not transplanted. There is not much chance of seedlings living after the top bud becomes black. I would not advise the planting of Pinus ponderosa (Bull pine) in this county, at least in this part of it. Although the germination of the seed was high, yet the growth of the seedling was slow. These seedlings were two years old and will not average above two and one-half inches in height, with very slender stems, although we cannot take this as a fair test on account of being lifted out by the frost. The fields are mostly pure sand and not suitable for nursery work. At present only enough seedlings to supply this reserve should be grown, on account of the labor question. The men would have to be boarded about five miles from the nearest place that laboring men could be had. The white pine transplanted were about the average of seedlings for their age. The few Norway spruces in the beds also were exposed and not worth transplanting.

Two hundred and seventy-five white pines and about three hundred bull pines were all that I found in condition to transplant. These were put into a bed prepared for them and covered with leaves.

THE STONE RESERVE.

ROBERT G. CONKLIN, Forester.

The Stone Reserve is situate in Tioga county, and consisted of about 42,565 acres at the time of the last report. This land lies on both sides of the Pennsylvania Division of the New York Central and Hudson River Railroad, extending from about Middlebury Centre south to near Jersey Shore, though most of it lies to the north and west of this road, and between it and the Potter county line.

It may be reached by the New York Central from Williamsport or Jersey Shore, or from Corning and Elmira in New York; and by the Buffalo and Susquehanna Railroad from Galeton, Potter county, Pa.

Either of the stations, Ansonia or Marsh Creek on the New York Central will give convenient access to this reserve. On the Buffalo

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and Susquehanna, the nearest and most convenient point is Ansonia, the junction of the Buffalo and Susquehanna and the New York Central. Persons coming from the north will take the New York Central at Geneva, Lyons, or Corning, in New York; from the northeast at Corning; from the south and southeast at Williamsport; and from the southwest at Williamsport or Jersey Shore. Persons coming from the west and northwest will take the Buffalo and Susquehanna at Galeton, Potter county.

The boundaries of the Stone Reserve being incomplete, what is called the Asaph Division of this reserve will, for the purposes of this report, comprise those lands which lie between the stations of Middlebury Centre and Stone on the line of the New York Central. While there is one block of land to the south of the railroad at Ansonia, the greater part is situate to the north and west of the railroad, and between it and the Potter county line.

While it may be said to consist of two bodies of land not touching each other at any point, the strip which separates them is very narrow, being the bottom lands on Pine Creek, above Ansonia, which stands at the junction of Marsh Creek and Pine Creek. As Pine Creek here flows generally eastwardly, the two bodies may be called the north and south sections of the Asaph Division.

The southern section is very irregular in outline, but has no tracts lying inside the outer boundary, owned or controlled by private persons or corporations. All of this land is now in the possession of the Department of Forestry, the leases and cutting rights having all expired.

The northern section is more regular in outline, all the outside lines, excepting those bordering on Marsh Creek, being north and south, or east and west lines. Of this section a large tract is still under lease by a lumber company, whose cutting rights extend until 1910. The remainder, however, is under the full control of the Department.

Topography and Geology.

Of the topographical and geological characters of the country, a book could be written, but this is not the time or place for a lengthy discourse thereon and so the report will be brief.

There are two nearly parallel mountain ranges running through Tioga county. One enters the county west of Ansonia and runs in a northeasterly direction, crossing the Tioga river two miles south of the village of Tioga, and from thence into Bradford county.

The other enters at the southwest corner of the county and passes through Antrim, Arnot, Blossburg, etc., and on into Bradford county. But the first one is the one with which we have to deal,

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PLATE X. Panorama, State Forest Nu

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: Nursery, Asaph, Tioga County.

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and the facts here given, while they may apply to the second range as well, are intended only for the first.

As stated above these mountains run in a northeasterly direction, but they are interrupted by short cross ridges. The mountains are generally narrow ridges with steep sides. The valleys are rather deep and narrow, the slope of one mountain seeming to rise from the foot of its neighbor.

In one instance, in the southern section, there is a broad flat upland of considerable extent. This is the Coulton clearing at the head of Bear Run. It would make good farming land were it easily and conveniently reached from the railroad; but as it is not, no more need be said about it, except that it will make a good site for a pine plantation.

Rocks and Soil.

As was before stated, the range which enters the county west of Ansonia is the one we are interested in. But the second one is the one the world at large is interested in, for these mountains contain the carboniferous formations and the coal measures. But we will proceed with the description of the first.

These mountains are not the result of upheavals, as is commonly the case, but of the erosion of centuries.

The exposed rocks of these mountains belong to the Chemung group of sandstones, which constitute the upper portion of the great Devonian system. In only one case does the carboniferous formation appear in these mountains until we get below Blackwells. This is on the mountain north of Asaph, which is capped with this formation.

The rocks of the Chemung group, being soft, yielded readily to the action of water, frost, and air. The shales of which this rock is largely composed also disintegrated rapidly, and constitute, where not capped by the carboniferous formation, the present soil, which is deep and fertile, and well adapted to agriculture where not too steep.

The soil over the whole of this division is well adapted to tree growth, even the decomposed carboniferous rocks furnishing soil that produces good trees; and, from the previous stands which covered these hills, it seems to be particularly adapted to the growth of pine.

Springs and Streams.

This entire region is well supplied with springs, but a curious fact is apparent at first sight. This is that the north side of the mountains and hills on the south bank of Marsh Creek are more bounti-

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fully supplied with springs than are those on the north bank of the stream. This is probably due to the inclination of the strata.

Both sides of the stream are, however, well supplied, almost every valley having its springs and little spring runs. Though many of these go dry during the summer months, during the spring and fall they are valuable stream feeders.

As for the streams, their history is very interesting and their present usefulness of some moment.

Prior to the glacial period, what are now called Pine Creek and Marsh Creek formed one stream. This flowed north through what is now the valley of the Crooked Creek, and emptied into the Tioga River about where the village of Tioga now stands. With the approach of the icesheet from the north, this stream was dammed up at Lawrenceville, and finally filled the whole Pine Creek Valley, clear up to where Gaines now stands. The way to the north being closed, its course was directed toward the south, and the present bed of the lower Pine Creek was started.

While the ice had something to do with cutting out this channel, the stream had cut its way down through the soft rocks for a considerable depth before the ice reached it. But on some of the rocks on the tops of the montains along Pine Creek may be seen the marks of the ice.

The channel of Marsh Creek, prior to the glacial period, being the channel through which what are now Pine and Marsh Creeks flowed, was cut much deeper than it is at present. But with the change in the direction of the creeks and the receding of the ice toward the north, the bed was filled with glacial debris.

So much for the history of these streams, and now for a word in regard to the present.

In a review of the present water system, the partition of the Asaph Division as before stated will simplify matters somewhat. Note that in speaking of Pine Creek, Upper Pine Creek will refer to that part between Gaines and Ansonia, and Lower Pine Creek, to that part south of Ansonia.

In the northern section, Marsh Creek flows along nearly the entire eastern boundary, while the creek occupies a similar position in regard to the southern boundary. Into these two empty all the smaller streams and finally these two effect a junction at Ansonia. From there they flow south as one stream, toward the West Branch of the Susquehanna.

In this northern section there are four main tributaries flowing from State land and emptying into Marsh Creek. Asaph Run, Straight Run, Kennedy Run, and Baldwin Run. These are all about the same size and are just good sized runs.

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In the southern section Pine Creek is the main stream. For some distance below Ansonia the State land is located on both sides of the stream, but about two miles south of Ansonia the line crosses to the west bank and thence continues south almost to Four-mile Run. This run empties into Pine Creek at Stone, at the southern end of the Asaph Division. Therefore Four-mile Run will form the southern boundary. In this section there are only four streams of any size flowing from State land. One I know no name for, the others are Darling Run, Bear Run, and Painter Run. Part of the waters of Four-mile Run come from State land through the right-hand branch of the run. Of course there are many small spring runs and some of larger size which I have not mentioned, but these are the largest.

Marsh Creek and Pine Creek are the two main streams. Marsh Creek flows sluggishly throughout its meandering course, forming a decided contrast to swift flowing Pine Creek with its rapids and falls. Pine Creek, in the time when this was a great pine country, was known as a famous drive stream. Each year thousands of logs were floated down this stream on the breast of the spring floods, to the mills at Williamsport. But now it is the exception rather than the rule to see a drive here.

The Growth.

The growth which covered these mountains and valleys when the first settlers came to this region was Pine and Hemlock of great size and value. In some cases, where the stumps are left to show, the trees stood about fifteen to twenty feet apart, giving from one hundred to two hundred trees per acre. Many of the trees were of such size that when sawed they gave what is known as "panel" pine. This is pine of great width, without a knot or "shake."

This virgin growth has been nearly all cut. Some few stands still remain, though none are on this division. In many instances a good yield of second growth pine has been cut from the land but this second growth stuff has not the size, quality, or value of the virgin pine. Many woodsmen have asked where the difference is. The trees may be of the same size, and they are both white pine, but there is a decided difference in the woods.

Much of the land of this division is made up of tracts recently cut over by lumbermen. Consequently there is little timber of any size remaining. In fact some sections support nothing but blackberry bushes, fire cherry, and scrub oak. But it is not all this way, for there are small areas on which there is good stock.

On the north side of the Buffalo and Susquehanna Railroad between Ansonia and Galeton, about half mile from Ansonia there is

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a good stand. This covers one side of a small mountain and part of the top. It consists of pine with a mixture of hardwoods, but the pine predominates. At the foot of the ridge, about four or five hundred yards from the railroad, is a strip of almost pure pine of good size.

Another growth of some size is found just above the New York Central tracks, about half way between Ansonia and Asaph. There is nearly a pure stand of pine along the foot of the hill, while further up the mountain a good growth of hardwoods is coming on.

But these stands of pine need immediate attention, as the trees along the Buffalo and Susquehanna are being blown over and left lying in the woods to rot, while that between Ansonia and Asaph does not seem to be healthy but apparently going back. There is a species of beetle working under the bark, which is peeling off in some places. This stuff would better be cut now and some revenue derived from it rather than allow it to go to waste.

These are about the only places where there is pine in any considerable quantity, and of good size; but in several locations we find hemlock and pine seedlings coming out in great numbers. And again, in some places we find a good growth of hardwoods about sapling stage, or larger. These consists of beech, birch, maple, elm, oak, hickory, and chestnut. There is also a little butternut in this region though of not any great size.

While hardwoods will grow very rapidly and produce good timber, the pine is the best tree for this region. In the past, nature has shown her preference, and we can not do better than follow her lead. While nature does not always make the most use of an area in regard to quantity, she is seldom wrong as to the species.

Report of Work on the Division.

As was before stated, a great portion of this division consists of lands recently cut over. Consequently the ground is covered with dry pine and hemlock tops, branch wood and old logs.

These old "slashings" are like powder mines, one spark and the damage is done; for they catch fire very readily, and, once started, burn with an intensity that kills everything in its path.

During 1907 there were four fires on this division, and one that burned almost up to the line.

On April fourth there was a small fire started in the open field just south of the New York Central tracks, between Ansonia and Darling Run. It soon ran up to the wood and had burned there some time before being discovered. This fire covered about ten acres of State land, but burned so slowly that it did not kill the larger trees.

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It was extinguished by the constable and one man. Cost $2.55, paid entirely by the commissioners of Tioga county.

On May thirteenth fire broke out on the hill on the left bank of Straight Run, about one-half mile from Marsh Creek station. This fire was thought to have been extinguished on the night of the thirteenth, but the morning of the fourteenth saw it in a far worse stage than before. From 3.00 P. M. on the thirteenth until 12.30 A. M. on the sixteenth, men fought this fire. About 11.30 P. M. May fifteenth, it started to rain, and after several ineffectual attempts, about 1.00 A. M. on the sixteenth it was raining hard. This completely extinguished the fire. Area burned over about 2,100 acres, all of which was State land. Total cost to fight fire was $67.15, of which $58.75 was paid by the county commissioners, and $8.40 by the Department of Forestry.

At this fire, great assistance was rendered by the Campbell and Hagenbuch Company of Asaph, and Ed. Matson, of Marsh Creek, by sending out their mill men to assist in extinguishing the fire.

About the same time there was a small fire on the mountain west of Stokesdale Junction. This was on State land, but did little damage, burning slowly, and was soon extinguished by the rain.

On August 13th two fires started on or near this division. One was on Mt. Tom, on the south side of Marsh Creek, about half way between Marsh Creek station and Ansonia. This fire did not start on State land, but before being extinguished had burned over a small State area. This land was covered with low brush and half rotten logs. In this tangle the fire hung for nine days, burning from August 13th to the 22nd, when a shower finally extinguished it. Cost to extinguish $46.15 not including the services of the ranger from the nursery.

On the same date, August 13th, fire broke out in the Four-mile country, on lands of the Central Pennsylvania Lumber Company. This fire was in old "slashings" and particularly fierce. The bill of expenses here given was incurred mainly by the men watching along the Central Pennsylvania Lumber Company's lumber road to prevent the fire from crossing the road and communicating to State land; but part of it was incurred by sending a crew in from Ansonia on the night of the 13th. Cost $60.70, of which $56.10 was paid by the county commissioners, and $4.60 by the Department of Forestry.

On August 15th a small fire occurred on the left branch of Straight Run, on State land, but was promptly extinguished by the surveying corps engaged in the survey of State lands. The prompt extinguishment of this fire is due to the coolness and good judgment of the young man in charge of the corps in the absence of the surveyor. About two acres only were burned over.

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Of these fires, one was supposed to have been set by a locomotive on the New York Central Railroad, two by farmers burning fallows, one from a logging train, and one from causes unknown.

The total area of State land burned by these fires was about 2,122 acres, most of which was brush.

There is the greatest need of better fire protection here if anything is to be done with these lands.

During May, as a preventive measure, we burned a strip of land lying between the New York Central Railroad and the public road, just below Ansonia. This strip was the only place from which the railroad could readily set fire to the recently cut over land on Mt. Tom, and by burning the strip that land was saved for one year at least. This cost the Department of Forestry $4.65, which was money well spent.

Surveys.

About May 27th, the survey of the outside lines of the State land in this county was begun, the work being in charge of a local surveyor familiar with the lines and land. This corps, up to the time work was suspended, had completed the survey of, and marked, posted, and painted 8,160 rods of lines. This required the running of many rods of trial line, materially increasing the cost of the survey, for some of the lines were run two or three times. Many of these lines were farm lines, which required more careful work.

The survey of the entire boundary of what is called the southern section was completed, and the southern and eastern sides of the northern section.

The total cost of the work was $1,102.96, or about $43.25 per mile. This does not include re-run and trial lines. The work, especially in the southern section, went slower than usual for here were many lines which had been run in an office only and never on the ground. The lines cross Pine Creek a number of times, and in one case ran directly up over the Pine Creek bluffs, nearly 1,000 feet high. This survey should be completed at the earliest possible date and the lines opened and painted. None of the lines so far run have been cut open, but should be opened in the spring.

Rangers.

There is need of more rangers in this country. In Potter and Tioga counties the State owns about 109,179 acres of land. Of this about 60,000 acres is under one ranger's supervision. This means that none of it gets anything like adequate protection. There should be at least five rangers for this territory, and in the spring

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extra men should be put on to patrol the railroads. These men should be young and strong, able to do a hard day's work when necessary. They should all be mounted, and have a thorough knowledge of the country, and of the roads, and trails and streams. And above all they should be honest and truthful, for much depends on these qualities in a ranger.

Roads and Trails.

During the year there were cut open and repaired 2,356 rods of road. These roads were opened to a width of eight feet, and everything removed. This work was done with the idea of fire protection as well as of making the different points of the division accessible. There were three roads opened under this work, one up the left branch of Straight Run, and one up each of the two branches of Kennedy Run.

The road on Straight Run is cut through nearly to the State line, and is intended to be intercepted by a road over the mountain from the right branch of Asaph Run. On this branch is a road which runs down to the village of Asaph. The two roads on Kennedy Run are cut through to the public road known as the Baldwin Run Road, leading from Stokesdale Junction over the mountains into Little Marsh.

The public road from Marsh Creek up the right branch of Straight Run, is opened all the way to its junction with the Baldwin Run road.

The three reserve roads and the public roads are so joined that they enclose about 6,000 acres of land and form excellent fire lanes for protection. (See sketch.)

On the Straight Run road a number of bridges were repaired, and two were removed and fords dug out in their stead. On the road on the right branch of Kennedy Run two bridges were repaired.

Total cost of the work was $63.70, being $62.84 for labor and $0.86 wear and tear on the tools. This makes the average price per mile $8.65, which is not excessive considering the bridge work done. The total cost of tools used was $5.70, and from their condition when work was stopped, fifteen per cent. off cost is a very fair estimate for wear and tear.

General Management.

Very little was done this year in the way of management or administration on this division, except the work done on the roads, the surveying of the line and ranging.

One case of a person using State land for private purposes was reported and settled by a promise on his part to leave the land and commit no further trespass.

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Camping permits were issued during the fall hunting season but no violation of the rules was reported.

The most important work done was the establishment of a nursery on this division at Asaph, and a report thereon will be found hereinafter.

The occupancy of these lands by the Department of Forestry has been a good thing for the county in more ways than one. The Department pays a fixed charge of five cents per acre for every acre of land it owns. This is more than is usually paid in the form of taxes on this character of land. It has given work to a number of men. Not that work is not plentiful here, for it is; but the State will continue to be an employer of labor after the lumber interests have been worked out. During the year the Department has spent $5,413.67 in this neighborhood. Of this $1,281.52 was for labor and the remainder for materials.

There are three things to be earnestly recommended:

1st. Completion of the surveys.

2nd. Extension of road work.

3rd. Better system of fire protection. This means the carrying on of road work as rapidly as possible, and the employment of more rangers. The employment of more rangers is especially to be recommended.

That portion of the State now within Tioga county has been a great timber country and, if given a fair opportunity will again become one of the best in the control of the Department.

THE ASAPH NURSERY.

Preliminary Sketch.

In the fall of 1906, the Forest Reservation Commission decided to establish a forest tree nursery in one of the counties of the northern tier. After due consideration and examination, a tract owned by Ed. Matson, Jr., and located in Shippen township, Tioga county, between Asaph and Marsh Creek stations on the New York Central Railroad, was leased. This tract, containing five acres, is located on the flat between Asaph Run and Straight Run, about three hundred feet north of the public road between Asaph and Marsh Creek.

The ground has a general slope toward the southeast of about

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one foot in a hundred, but the surface in places is somewhat rolling, giving hillocks and hollows of various slopes. These slopes are not decided enough to affect the land's usefulness for a nursery.

The soil is a sandy loam about fifteen to twenty feet deep, with a sub-soil of sand and gravel. It is well watered, too much so sometimes, as the slope is so gentle that during a very heavy rain it does not carry the water away fast enough. But there is another consideration which far over balances this. The water table does not lie over six feet below the surface, as a rule. During the spring and fall it approaches to within three feet of the surface; and even during the long drought of August of this year, at a depth of twelve feet, we found an abundance of good water. This is due, no doubt, to the fact that during the summer months the waters of Asaph Run flow through the gravel sub-soil of this flat, coming out below the public road as numerous springs. During this period the bed of Asaph Run, from above the location of the Campbell and Hagenbuch mill to the mouth of the run, is entirely dry. The abundant supply of water in the sub-soil of the nursery makes the selection of this site a very fortunate one.

But the location has one bad feature. This is that it is exposed to the winds from four directions, and is also exposed to the full force of the winter's snow, rain, and wind. A windbreak of some hardy evergreen planted around the fence, would remedy this to a great extent.

The nursery itself is a rectangular plot of ground 871.2 feet long by 250 feet wide. It lies with the long side parallel with Asaph Run and the short side parallel with the public road.

IMPROVEMENTS.

Fence.

The entire plot of five acres is surrounded by a wire and board fence seven feet high. The upper five feet are of Page woven wire fencing and the lower two feet, of one inch hemlock boards. In addition to this there is one foot of board under ground for the purpose of excluding rabbits, mice, etc.

Total cost of fence is as follows:

Boards and posts,	$220 20
Wire fencing,	97 06
Staples, locks, etc.,	5 24
Labor,	144 48
Total,	$466 98

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Within the nursery there were erected the following buildings during the past year:

Office.

A frame building, sixteen by twenty-six feet, two stories high, finished inside with Georgia pine. On the first floor is an office and a seed-room, and on the second floor are two bed rooms. This office has been furnished to large extent by the Department, so that now the Forester in charge may live right on the ground.

Total cost of the office and furnishings is as follows:

Building (contract price),	$712 50
Extra work,	10 00
Foundations,	42 20
Building complete,	$764 70
Furniture,	212 09
Total,	$976 79

Tool House.

A frame building twelve by sixteen feet, well lighted; also fitted up as a work shop, containing a work bench, bench vice, etc. This building is used as a store house for such supplies as cement, nails, etc.

Total cost of the tool house is as follows:

Lumber,	$54 57
Hardware,	5 68
Windows, roofing, etc.,	12 00
Labor,	12 00
Total,	$84 25

Stable.

Frame building, two stores high, constructed of surfaced lumber, and well stripped. First floor contains two stalls, feed bin, etc. Second floor, hay-loft, etc. To the north is the wagon-shed, having space for two wagons, and a loft for storing odds and ends.

Total cost of stable is as follows:

Lumber,	$99 86
Hardware,	24 98
Windows,	3 75
Labor,	41 75
Total,	$159 72

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There was also constructed an out-house four by six feet, of German beveled siding, costing $13.52.

Of these improvements, the office was built by a contractor; the remainder under the supervision of the forester.

The total amount expended on buildings was $1,701.26. In addition to this there was expended $62.50 for ground rent, and $35.96 for repairs, walks, etc. This brings the total for grounds and buildings to $1,799.72. Of the cost of labor on the stable $9.10 is not charged to ground and building but to operation, being part of the salary of the ranger. Hence the total charge on the books for ground and building is $1,790.62.

Laying Off the Ground.

The nursery is laid off in three sections, lettered A, B, C respectively. These sections are separated by roads nine feet wide running the full length of the field. In addition to these, at the upper end of the lot, the two roads are connected by another ten feet wide, and at the lower end by another twelve feet wide. This lower road runs on by section C to the gate.

Section A is on the northeasterly side, fifty-eight feet wide. Section B, in the middle, is one hundred and sixteen feet wide. Section C is nearest the gate and on the southwesterly side, fifty-eight feet wide.

These sections are laid off in beds sixty feet long and four feet wide, with a three-foot path between every two beds. As the beds run parallel with the long side of the field, it leaves a five-foot path around the lot.

About half way up the nursery is a row of beds running across, only forty-two feet long. In the middle section, or B, the beds are not made up, the ground being used for storing screens, stakes, etc., and for compost heaps. This is called the storage ground.

In sections B and C, the first row of beds has also been left out. On these two areas are located the office, toolhouse, and stable.

Counting out these three lots or beds, the nursery will contain, when all the other beds are made up, four hundred and four sixty foot beds, and sixteen forty-two foot beds. This will give a total of 99,648 square feet of bed area; or, counting six seed-rows to the bed, and running length-wise, 149,472 lineal feet of seed row.

Nursery Work.

Work was begun here on April first, but owing to inclement weather, very little was accomplished until April 15th; and even

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after that, until May 10th, things went rather slowly on account of the weather.

About April 15th work was started on the fence, and when the soil was dry enough, on the beds. But up to May 1st, very little had been done on the beds. After May 1st, however, the work went along rapidly.

The beds were spaded to a depth of fourteen inches, and well worked with a rake. The soil from the paths was thrown up on the beds, raising them about six inches above the paths. After thoroughly working up the soil, the beds were leveled up, the sides packed, and they were ready for planting.

The hickories were planted first, then part of the tulip poplar. Next the white pine was planted, then the remainder of the poplar, and then the other seeds as the beds were ready.

The hickories, poplar, ash, cucumber, and persimmon were planted in Section C. Section A was planted entirely in white pine, and Section B was planted with the remainder of the pine, and with the other conifers. Section B not holding all the conifers, thirteen beds in Section C were planted in sugar pine, larch, and Norway spruce.

The broad-leaved tree seeds and the sugar pine were all planted by hand, but the others with a Planet Jr. machine. This machine puts the seeds into the ground to any depth required and as many in the row as desired. It covers them after planting, and at the rear of the machine is a broad wheel which packs the soil slightly over them.

The hickories were dibbled in, while the ash, poplar, persimmon, cucumber, and sugar pine were planted by hand in rows made with the small plow of the Planet, Jr.

Seeds Sown.

Between May 10th, when the first seed was planted and May 24th, there were planted here the following seeds:

White pine,	175 lbs.
Scotch pine,	10 lbs.
Sugar pine,	5 lbs.
Norway spruce,	5 lbs.
Balsam fir,	5 lbs.
European larch,	5 lbs.
Shellbark hickory,	40 lbs.
Bitternut hickory,	40 lbs.
Tulip poplar,	25 lbs.
White ash,	10 lbs.
Persimmon,	5 lbs.
Cucumber,	5 lbs.

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PLATE XI. Mount Tom, Tioga County. Timber Stripped and Showing Water Erosion.

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Total cost of making up the beds was as follows:

Labor (April 27 to May 25),	$259 53
One load muck,	1 50
Total,	$261 03
Total cost of seeds planted was,	501 55

The cost of making up the beds was a little high because the men were unable to go ahead with them continuously, but had to work whenever the soil was dry enough.

Protection.

As soon as the seed were all in the ground, the making of the screens was started.

These were made by nailing four-foot pine lath to six-foot one and one-half inch hardwood strips, the lath being spaced from one inch to one and one-half inches apart, and projecting about two inches beyond the edge of the strips.

Then the stakes were driven into the beds, six feet apart lengthwise, and three feet eight inches apart across the beds. This allowed the strips on the screens to slide down inside the stakes and the lath to rest on the tops of the stakes. Later in the season short pieces were nailed to the inside of the stakes, just far enough below the top to allow the strips on the screens to rest on them. This gave two bearing surfaces or supports for the screens.

In making these screens there were used fifty thousand pine lath and about four thousand hardwood strips. About four kegs of 4d wire nails were used in the making.

When removed from the beds and piled for the winter, there were 1,765 six-foot screens on hand. And in addition there were about four hundred strips not used. For the beds there were purchased six thousand six hundred hardwood stakes, each two inches square and three feet long, pointed at one end and squared at the other. Of these only 3,762 were used this season, the remainder being piled so as to be exposed to the weather as little as possible and yet be open to the drying winds.

Cost of 1 six-foot screen, including material, labor, etc.,	$0 23
Cost of covering 1 bed, including materials for 10 screens, 22 stakes, and labor for driving and manufacturing,	3 21
Total amount expended for screens and stakes, including unused stakes and screens,	607 50

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Weeding.

The weeds were an expensive enemy to deal with. When weeding first began to be a necessity, during the latter part of June, boys from seven to twelve years of age were tried. These not proving satisfactory, girls were induced to try it, and proved to be very satisfactory. Boys put in fewer days to the month, and worked less steadily than the girls. Daisies, pigweed, and grass or timothy were the most abundant growers and caused the most trouble.

Generally weeding is finished about the first of September, but this year September and October were so warm that most of the beds put forth a heavy crop of weeds. This required October weeding. Most of the weeds were low and spreading, lying close to the ground, which made the work very much harder.

The weeding was made less tiresome by the use of benches which were furnished at the nursery. These benches were long enough to go across the beds and high enough to clear the tops of the seedlings. They were made from odds and ends and did not cost very much.

During the months of July and August, the top two inches of soil in the beds was kept finely pulverized. This was done by the weeders with three-tined weeding forks. Only twice was it necessary to do this for during these two months very little rain fell and the soil was not moist enough to bake.

On some of the beds, early in the season, moss had started to grow, but one or two days exposure to the sun and deep cultivation soon destroyed it.

Total amount expended for weeding was $357.16.

Fall Work.

About the first of September the gathering of pine needles for covering the beds was started. The exposed position of the nursery made it impossible to use broad leaves as they were immediately blown away. Hence we were of necessity compelled to us pine needles only.

There being no pine groves of any size near here, we were able to secure the needles only at a distance. This somewhat increased the cost of the covering. About seven loads were secured from Ansonia, a haul of two and one-half miles. These seven loads were but a very small part of the necessary needles and we had to look elsewhere.

At Middlebury, seven miles above Marsh Creek, we obtained one car load of needles. Here we had to haul the needles almost a mile to the railroad, and had to take the men from the nursery and

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pay their board there, as men could not be had in the neighborhood. But taking all these things into account as well as the hauling from the car at Marsh Creek to the nursery, the price was less per load than those procured at Ansonia. Twenty-three two-horse wagon loads were packed into one car, making, with those from Ansonia, a total of thirty loads; but this was not enough. To complete the covering we used a few loads of needles and broad leaves mixed, which were procured about a half mile back of the nursery. With the quantity of needles and leaves, all the beds except thirteen were covered, and the seedlings in these thirteen beds were taken up and heeled in for the winter. The needles were placed carefully between the rows of seedlings and packed close to the stems by hand. A total thickness of needles about equal to the height of the seedlings was used.

The screens were removed from the beds a few at a time, and the needles placed immediately. This exposed the seedlings to the warm October sun for as short a time as possible. As fast as the screens were removed they were carried to the storage ground and piled for the winter. They were placed fifty to the pile, and very carefully spaced, the bottom screen being raised on a two by four to prevent rotting from contact with the ground. On this storage ground were also placed the stakes not in use.

Total cost of removing and piling screens and covering the beds was $233.72, or about $1.50 per bed. With a little care, these needles may be used for another season and possibly two, thus making the cost not excessive.

A note in reference to the comparative cost of the needles from Ansonia and those from Middlebury will not be amiss here. The needles from Ansonio cost $5.15 per two-horse wagon load, while those from Middlebury cost $4.36 per two-horse wagon load. These prices include everything up to the placing on the beds.

Results of the Work.

At the end of the season when account was taken of the seedlings on hand, there were in the nursery beds the following:

Conifers.

White pine (Pinus strobus), ...	279,579
Scotch pine (Pinus sylvestris), ...	35,000
Norway spruce (Picea excelsa), ...	35,275
Balsam fir (Abies balsamea), ...	18,275
European larch (Larix europea), ...	16,675
Sugar pine (Pinus lambertiana), ...	125

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Hardwoods.

Shellbark hickory (Hicoria ovata), ...	530
Bitternut hickory (Hicoria minima), ...	232
White ash (Fraxinus Americana), ...	6,054
Persimmon (Diospyros Virginiana), ...	850
Total, ...	393,070

The tulip poplar and cucumber were both failures, neither one germinating to any extent. This very materially reduced the crop and increased the average cost.

While this is not a fair sample of what this nursery is capable of doing and what it should do in the future, it is a fair crop considering the fact that this was the first year, and also the very unfavorable weather from April first to June first. The spring was late, while October and November, when we should have been having cold weather, were more like spring.

The following is a condensed statment, taken from the United States Government Monthly Weather Reports, and given here for the purpose of showing something of the weather conditions during the spring planting season:

April. Snow flurries almost daily, and in the northern counties, in considerable quantities. Total precipitation 2.11 inches, including 4.4 inches of snow unmelted. During the month there were eleven clear days, eight partly cloudy ones, and eleven stormy ones. In addition the average temperature was the lowest in eighteen years, being almost five degrees below normal.

May. Snow flurries and rain in the early part of month. Total precipitation 2.35 inches. During the month there were twelve clear days, twelve partly cloudy ones, and seven stormy ones. The mean temperature was the lowest in eighteen years, being more than five degrees below normal.

June. This month was also extraordinary. The temperature was nearly five degrees below normal, while the rainfall was nearly one inch more than normal. Total precipitation was 4.49 inches. During the month there were ten clear days, twelve partly cloudy ones, and eight stormy ones.

From April first, until the end of June the season was about three weeks late. Then during the latter part of July there came a long and hard drought, which lasted until the latter part of August. During this drought we watered some of the best beds; a tank, to be mounted on a wagon truck, having been provided for this purpose. But there was not pressure enough to force the water out of the tank through the hose. So most of the watering was done

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with sprinkling cans. While this was not very satisfactory, and necessarily restricted the area watered, it was the only way with the means at hand. And to carry out the unseasonable weather, the fall months were more like spring than fall.

So all things considered, while the crop was not a phenomenal one, it was a good crop for 1907.

Experiments.

This being the first season for this nursery, very little was done in the way of experiments.

One that was tried was the use of muck soil for fertilizer on the beds. In one case, after the natural soil had been worked up, a layer of muck was spread over it to a depth of two inches and worked in with a rake. In another case, the muck was spread over the top after the bed was leveled, but before the seed was planted. But none of the beds on which this muck was used show any better results than those on which none was used, except, perhaps, in the production of weeds. Whether or not another season will show any different results, remains to be seen, but the fact is that it was not a success the first season.

Another experiment which was tried was that of leaving the bed unprotected, except by the screens. A bed in which there were only about one hundred and twenty-five seedlings was selected for this purpose. Nothing was done to the bed except to leave the screens on. This is to determine whether the cold will kill the seedlings or not, and also the action of the frost upon them.

While the Mont Alto nursery has found that heeling in of seedlings does not pay, we have tried the experiment again. There were thirteen beds for which there were no needles. So the seedlings were raised and heeled in for the winter. A special heeling in ground was prepared by raising a portion of a bed about twelve inches above the path. This will allow of good drainage.

The seedling were placed in bunches and these bunches in rows running across the bed, the rows being about ten inches apart. The soil was firmly packed around the roots, and the whole surface covered with needles, leaving only the tops of the bunches exposed. Screens were placed over them to keep off the greater weight of the snow and ice. Whether or not this will be a success remains to be seen, but in the event of its failing there will not be much lost as there were only eight thousand seedlings in the thirteen beds.

Conclusions.

As the full financial statement is given on another page a lengthy statement will not be necessary here; but one or two facts are worthy of separate mention.

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During the past season the Department of Forestry paid out for labor to the people of this community $1,281.52. There was also paid out for salaries $1,195.00, most of which went into the hands of the tradesmen of the community. Then there was paid out to different firms of the vicinity, $1,867.46 for materials of various kinds. These, with an expense account of $132.84, and some few items not charged to the individual accounts, give a total of $4,510.23 spent in this county this year.

Another thing to be remembered is that the nursery afforded an opportunity to the boys and girls to earn money of their own in an out-of-doors occupation, light and healthful.

Wages in this county are higher than we have to pay in some other places, but they are not beyond reason. In the beginning we had to pay twenty cents per hour for men, but later this was reduced to eighteen cents per hour. And when you take into consideration the fact that these men can go into the woods and get forty dollars per month and board, the year round, the fact that they want a little more for a job which lasts a few months, is not surprising. And until things can be put into such a shape that a regular force of laborers can be employed the year round, we will have to submit to a little higher wage rate. This matter of a regularly employed force is one that will come up for discussion in the near future, and will have to be settled before long.

The location selected for this nursery is a wise one for more reasons than one, but one main reason is that this country has been a great pine producing country. This would indicate that there is something in the soil and air peculiarly adapted to that species. Therefore the pine seedlings should do well, and transportation to a favorable planting ground will be easy. Thus these old hills may once more be covered with pine, and deserve in the future the reputation they have earned in the past, of being great pine producers.

Financial Statement for 1907.

By checks received,		$4,510 23
By bills unpaid,		46 52
By bills paid by the Department,		856 92
Fire service,	$11 25	
Roads and trails,	68 54	
Surveys,	10 69	
Seeds,	501 55	
Equipment,	162 27	
Operation,	1,894 69	

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Ground and buildings,	1,790 62	
Protection,	841 22	
Expenses,	132 84	
Total,	$5,413 67	$5,413 67
Amount paid out in salaries,		$1,195 00
Amount paid out for labor,		1,281 52

Inventory.

Ground and buildings,	$1,790 62
Protection (stakes, screens, etc.),	689 12
Equipment (tools, tank, etc.),	150 00
Seedlings,	1,988 12
Reserve improvements,	90 48
Investment,	705 33
Total,	$5,413 67

Value of Seedlings at End of Season.

White pine, 279,579,	$1,397 90
Scotch pine, 35,000,	245 00
Norway spruce, 35,275,	105 83
Balsam fir, 18,750,	112 50
European larch, 16,675,	83 38
Sugar pine, 125,	2 50
Shellbark hickory, 530,	4 24
Bitternut hickory, 232,	1 40
White ash, 6,054,	30 27
Persimmon, 850,	5 10
Total	$1,988 12

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A SILVICAL STUDY OF THE ROCK OAK (QUERCUS PRINUS), WESTERN FRANKLIN AND EASTERN FULTON COUNTIES.

JOHN L. WITHEROW, Forester.

As the time for this work has been short and being the first of its kind in this locality, what follows will necessarily be incomplete, but will probably serve at present for comparison and show to a limited extent the behavior and influence of this species in the forest.

The rock oak has been one of the most widely distributed and extensively lumbered species of this part of the State. Although it seldom grows in "pure stands" yet it is usually the dominant species of the stand in which it grows. It is found in many different situations with regard to elevation, mixture, and soil, but as a rule in mixture with chestnut, red, white, and black oaks on sandy, well drained ridges, when it seems to attain its best growth both in quality of trees and amount per acre.

In rare cases and in small areas where drainage is good and the soil quickly loses excessive moisture, rock oak is found in pure stand; however where soil moisture is less constant chestnut and other species appear until rock oak may form only one-third of the stand.

On the summits of the highest mountains of these reserves, an elevation of about eighteen hundred feet, this species is stunted, short, and branchy, and has the appearance of a species near the "timber line" on a lofty mountain, which is due to temperature, poor protection, and dry soil.

Much damage has resulted to the growth and reproduction of this species in the past from the ranging of cattle, sheep, and hogs on these reserves, by farmers living nearby; also that clear cutting has beeen done repeatedly over the most accessible parts of these lands until about forty years ago, for wood to supply several iron furnaces with charcoal. This has reduced the character of growth considerably.

Fire very often spreads from the "charcoal job," passing over large areas, and although few trees to-day have injured trunks, yet where fire has not occurred the humus is thicker, average height greater and more on the ground than stands of this species of the same age where fire passed through.

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In comparison with the species with which it grows it is not easily killed by fire owing to the rough thick bark on the trunks, and when so killed is rarely made worthless, but can usually be marketed profitably. It will remain on the ground for several years before rapid decay takes place.

Nearly all reproduction is by coppice sprouts which start to grow the same year or the one following the removal of the forest. Its reproductive power by this method is strong, as the coppice may be killed several times and the trunks will put out other shoots.

Natural reproduction from seed occurs only in places where humus is present and an opening in the forest of sufficient size to admit light is made. Here the acorns may find conditions suitable for germination.

In the coppice forest the old stumps remain at the base of the young trees for thirty years before decay takes place. For this reason stumps of this species should be cut low whether either method of regeneration is expected.

As with many other species the life of the coppice growth is shorter than that of the "High Forest" and the seed of an inferior quality.

Seed years do not occur at regular intervals, but rather seem to be governed by climatic conditions and the amount of available tree food. Occasionally there will be a crop for several years in succession, after which there may not be another for three or four years. The acorns are never produced in large crops and they germinate soon after falling, which confines seed regeneration to small areas. Seed dispersal is mostly by water and the rolling of the acorns down slopes.

When trees grow in the open the trunk divides into large branches about twenty feet above the ground, and forms a large, wide crown. Such trees produce a small amount of lumber. In the forest where favorable conditions are present it develops a long, clean bole sixty-five feet in length with a short crown.

If trees of this species are permitted to stand after they become mature decay begins at the heart and rapidly continues outward until all inside is gone, leaving a hollow shell which very often remains standing for many years as a breeding place for insects and fungi.

Relation of Age to Diameter.

Table I shows the average diameter which a tree will reach at different ages on land where fire has never been known to occur.

The fastest growth is made from the third to the twenty-fourth

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year, when it falls off slightly, and from then until the fifty-fourth year the rate of growth is nearly uniform.

From the fifty-fourth to the eighty-fifth year it decreases rapidly, after which it becomes too slow to add much to the volume of the tree.

TABLE 1. AGE OF ROCK OAK.

Age. Years.	Diameter breast high. Inches.	Age. Years.	Diameter breast high. Inches.	Age. Years.	Diameter breast high. Inches.	Age. Years.	Diameter breast high. Inches.
5	1.5	25	6.8	45	11.3	65	15.2
10	2.9	30	8	50	12.4	70	16.1
15	4.3	35	9.1	55	13.4	75	16.9
20	5.6	40	10.2	60	14.4	80	17.6

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TABLE II. AGE OF ROCK OAK ON BURNED AREA.

Age. Years.	Diameter breast high. Inches.	Age. Years.	Diameter breast high. Inches.	Age. Years.	Diameter breast high. Inches.	Age. Years.	Diameter breast high. Inches.	Age. Years.	Diameter breast high. Inches.	Age. Years.	Diameter breast high. Inches.	Age. Years.	Diameter breast high. Inches.	Age. Years.	Diameter breast high. Inches.
1	.25	10	2.3	19	3.8	28	4.9	37	6	46	7.1	55	8.1	64	9
2	.48	11	2.5	20	3.9	29	5	38	6.2	47	7.3	56	8.2	65	9.1
3	.71	12	2.6	21	4	30	5.2	39	6.3	48	7.4	57	8.3	66	9.2
4	.94	13	2.8	22	4.2	31	5.3	40	6.4	49	7.5	58	8.4	67	9.3
5	1.2	14	3	23	4.3	32	5.5	41	6.5	50	7.6	59	8.5	68	9.4
6	1.4	15	3.1	24	4.4	33	5.6	42	6.7	51	7.7	60	8.6	69	9.5
7	1.6	16	3.3	25	4.6	34	5.7	43	6.8	52	7.8	61	8.7	70	9.6
8	1.9	17	3.4	26	4.7	35	5.8	44	6.9	53	7.9	62	8.8	71	9.7
9	2.1	18	3.6	27	4.8	36	5.9	45	7	54	8	63	8.9	72	9.8
														73	9.9
														74	9.98
														75	10
														76	10.1
														77	10.2
														78	10.3
														79	10.4
														80	10.5
														81	10.6

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Table II shows the average diameter breast high for each year of age up to eighty-one, on land which has been burned over repeatedly.

Relation of Age to Height.

Table III shows the average height of trees at various ages. Height growth drops off rapidly from the fifth to the twenty-fifth year, after which it continues to the fortieth year at nearly a uniform rate. It decreases rapidly from the fortieth to the eighty-fifth year, when it practically ceases.

TABLE III. HEIGHT OF ROCK OAK AT VARIOUS PERIODS.

Age. Years.	Height. Feet.	Age. Years.	Height. Feet.	Age. Years.	Height. Feet.	Age. Years.	Height. Feet.
5	11.4	25	39.3	45	57.5	65	67.8
10	20.9	30	44.5	50	60.5	70	70
15	28.4	35	49	55	63	75	72
20	34.4	40	53.5	60	65.5	80	73.5

Table IV was made of a survey of three-fourths of an acre of rock oak as nearly a pure stand as could be found of this age. The object in view was to determine the per cent. and size of this species in comparison with that of the others in the stand.

The primeval forest was removed eight years ago and the present stand has grown since from seed. It is on a well drained northern slope with a good quality of slate soil and thick humus and may be regarded as nearly normally stocked as can be found in a wild forest.

TABLE IV. PERCENTAGE AND SIZE OF ROCK OAK IN MIXED STAND.

Species.	Average diameter breast high. Inches.	Average height. Feet.	Number of trees of each.	Maximum diameter breast high. Inches.	Minimum diameter breast high. Inches.	Per cent. of stand.
Chestnut,	10	55	27	18	5	.175
Red Oak,	14	63	11	17	7	.06
Black Oak,	11	57	8	15	7	.055
Hickory,	5	35	4	8	4	.03
Rock Oak,	11	67	105	16.8	5	.68
Total,			155			100

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No effort was made to determine volumes for trees of different ages or of areas on account of it being impossible to market profitably the number of sample trees it would have been necessary to cut.

TIMBER ON PENNSYLVANIA FOREST RESERVES.

DR. J. T. ROTHROCK, Member State Forestry Reservation Commission.

The impression appears to prevail in certain quarters that the Forestry Commission has been able to purchase nothing but land from which the timber has been wholly removed.

It is true that the maximum price which the Commission is authorized by law to pay is usually insufficient to tempt owners who have bodies of valuable timber, and, therefore, what is known as "cut-over lands" are the most frequently secured. The term "cut-over," however, is a relative, and not an absolute designation. Its meaning varies from year to year, and it varies in the minds of the lumbermen themselves. For example, to one man lands would be cut over when the hemlock was removed, though they might still yield a rich harvest of beech, birch, and maple to the stave man, or the charcoal burner. An actual instance will illustrate how time is an element in this term. Eight years ago the Forestry Commission purchased land from a gentleman who thought he had cut off all he could profitably remove. So he had at that time. The price paid was $24,000. Recently the same gentleman made a formal offer to buy those lands back at a price of $60,000, because, first, there has been an increase of size during that period of eight years, and second, because increasing scarcity of timber and higher price has made the timber which he neglected in 1900 as worthless, immensely valuable now.

With regard to most land offered now, if there are existing timber leases, the Commission refuses to purchase unless there can be fixed some reasonable limit in size, below which all trees must be allowed to remain. This then gives the start of a new forest.

But the above is by no means a true statement of facts for all of the purchases. The State has acquired considerable sized areas on which there remains from eight to fifteen thousand feet of lumber to the acre. The accompanying photographs will illustrate and enforce this truth. Then on many acres of the State Forest land,

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there are hemlock trees which have a diameter at base of from two and a half to three feet, and from which there could be taken a length of fifty feet of merchantable timber. It is not unusual to find a number of such trees on each acre.

It is well in this connection to remember that a log of forty feet length and two feet in diameter contains one thousand feet of lumber, board measure, and that a log of the same length having a diameter of three feet would contain more than two thousand five hundred feet.

The question is frequently asked, why should not this mature timber be cut and placed upon the market? There are several reasons why it should not be cut:

First. The State is buying land to increase its timbered area, and is not selling.

Second. For years there has been a demand that the Forestry Commission should buy and maintain some just such tracts, as an object lesson for the future.

Third. If the timber is cut off and the soil laid bare the conditions under which the present stand grew will be so completely changed as to make it impossible, without great expense, to restore a similar crop of hemlock; whereas, if allowed to remain the present growth will (and is now) perpetuating itself, and the longer it remains under present conditions the more valuable will its hemlock crop become. It is to be hoped that no pecuniary consideration will lead to the sacrifice of these primeval forests which the State now owns, and which soon will be about the only bodies of original timber within the Commonwealth.

But besides the growth above alluded to, the State has timber of large size of other species than hemlock. In the Pennypacker Reserve there are white oak and tulip poplar trees still growing vigorously which contain not far from a thousand feet of lumber. Indeed, there are many such trees met with in an hour's walk. There is also a vigorous growth of clean, straight hickory, which is now of marketable size, and is still rapidly increasing in value. Some of the photographs taken show a young white oak forest which should be the admiration of any forester.

But why value these trees solely for their worth in dollars, or as lumber? Sentiment is not wholly despicable. Without it there could be none of that love of country which we call patriotism. It usually has been the mainspring of reforms and of movements which lead to a healthier national life. It has its claims which are weighty enough to compel consideration, and the sight of such forests as we refer to, is an inspiration which will become more and more elevating as our country passes from its growing into its maturer condition.

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Wherever a forest stands which is mature enough to produce seeds, it is a center from which the wooded area widens by growth, resulting from diffusion of seeds. The white pine woods at Mont Alto are the result of a few white pine trees whose seeds the wind scattered on abandoned fields. From mature oak and chestnut trees squirrels and jay birds carry away and distribute the fruit which produces new forests, and we wonder where the seed came from.

So that it appears as if the cash into which these mature woods on the State Reserve might be converted just now, would be a paltry return for what the Commonwealth lost by the transaction.

Until others as good, as large, and as striking can be produced it would be folly to cut these down. Let them stand to illustrate what the name Pennsylvania means.

RESTORATION AS WELL AS PRESERVATION OF OUR FORESTS NECESSARY.

HON. S. B. ELLIOTT, Member of the State Forestry Reservation Commission.

A deep concern in things pertaining to forestry is being shown by those who have the welfare and prosperity of our country at heart; and it is well that it is so, for there is no more important subject for the people to consider. A gratifying feature connected with the interest so widely manifest is that it demands the preservation of such forests as are left us; yet it is greatly to be regretted that the need of this could not have been seen long ago, for much has been lost by delay and the work that must now be done will be far more difficult that it would have been a score or more years ago. But the people could not be made to see it then, nor later on, nor even now would they, did not the convincing logic of experience compel them to. The growing scarcity, the high price, and low standard of quality of lumber offered in market, to which is added the discovery of the further fact that the destruction of the forest causes serious disturbance of the equable flow of springs and streams with resultant disastrous floods, have combined to force attention of the thinking public to the deplorable results which must follow further lack of regard. Hence there is now a demand for the preservation of existing forests. There is no question but what

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they should be preserved, but just what each one conceives "preservation" to embrace is quite another thing. One may demand that they shall not be cut at all. That would certainly be preservation in the extreme. Another may insist that the forests shall be made to furnish continually what are known as forest products, such as lumber, fuel and the like. That would be preservation with use and certainly commendable. Fortunately neither of these parties will consent to any further destruction.

But will they see that preservation alone of present forests, no matter what system of treatment may be followed, must sadly fail to provide an adequte supply of forest products? There is where danger lurks. A conception of the truth of their inadequacy must be realized or preservation will prove only a halfway remedy for the ills which threaten us. We must have a greater area of productive forests to meet the demands of our progressive civilization. We are consuming our forests three times faster than they can grow. It is not necessary to discuss what this rapid consumption sooner or later will result in if nothing be done to increase forest production in some form. The only way to escape the severity of a timber famine already being felt is to reduce consumption or increase production. We cannot well lessen consumption but we can increase production.

This conclusion once admitted, and it will be forced upon us soon, just as preservation has been, the question arises, can such increase of production be accomplished, and, if so, how? The answer must be: Reforest the cut-over non-agricultural wastes that once bore a dense growth of timber trees, but are now destitute of all valuable growth, by planting such species of trees thereon as are best adapted to the location that will mature the earliest, and produce the most satisfactory products. No doubt it will be claimed that reforesting of these so-called cut-over lands will result from natural causes of protection from fire be given them, that nature has provided for such restoration through sprouts and young growth which so universally spring up after the useful trees have been removed. At first glance this would seem plausible. As nature originally brought forth the forests will she not do so again? And, besides, is not this view confirmed by experience in the past when lumbermen cut only the largest and best trees, and, when protected from fire, the younger growth came forward and more or less of it has since been cut for use? None of this should be denied for it is quite true. But the fact must be recognized that conditions are vastly changed now. Within a score of years large demands for all sorts of forest products have sprung up and consumers have found themselves forced to use different kinds and poorer grades than heretofore. For sev-

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eral years the lumberman, the railroad tie man, the pulp man, and the acid factory man have taken about everything in the line of tree growth that could be found standing on the ground. There are no seed trees left nor any small growth that has not been injured by lumbering operations. There is really nothing left from which a forest of valuable species of trees can spring. Not only are the virgin forests being thus destroyed but what has heretofore been left by axe and fire on previously exploited areas is being removed. The lamentable fact is that no young growth is being left to come on, nor are forests being left for us to preserve. It is admitted that there are exceptional cases but they are rare.

No greater mistake can enter the mind of any individual than to suppose that what little tree growth now standing on land cut over by modern methods of lumbering, or on fire-scarred, devastated and practically barren land, will ever amount to anything of value for timber and general forest products.

Examination will show that not over twenty-five per cent., if so much, of these lands, even where a young growth is coming on, has a stand of valuable sepcies that is at all commensurate with the needs of the future, or that can bear a fair comparison with what originally stood there. Recent Census Bureau Reports (July 11, 1908), show that seventy-nine and two- tents per cent. of the lumber cut in the sawmills of the United States in 1907 was from the conifers, the pines, spruces, firs, hemlock, cypress and other so-called soft woods, and nine and two-tenths per cent. was of the several oaks, leaving only eleven and five-tenths per cent. for all others, such as basswood, cherry, poplar, maple, hickory, walnut and other broad-leaf trees. Can any such ratio of valuable species be found standing on the devastated lands of to-day, or will there be where the virgin forests are when the lumberman completes his work? Then there is a vast area where fire has killed everything, even bird cherry, aspen, and other worthless stuff so common in many regions. The axe and fire have wrought awful destruction of our forests and made that destruction "doubly sure and sealed it with a bond of fate." Whoever disputes this should go on to these lands and make careful examination. There he will see the worthless species, the weed trees, the crooked, low-limbed, diseased, fire-scarred, worthless stuff that will suppress any growth of more valuable trees, should seed ever be scattered; and then, too, will be seen the disappointingly small number of valuable species mingled with the others. Turning from this he will see the fire-scarred, barren, desolate wastes where no trees are growing.

It may be claimed that we can depend upon sprouts from stumps of cut trees to produce a second growth where no seed trees have

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been left. We must not hug that delusion for there are only three or four valuable species that will sprout at all, and of these the chestnut is the only one that can be depended upon. None of the conifers will sprout except the redwood.

The foregoing is a truthful picture of what examination will show to be largely the condition of the cut-over non-argricultural lands of the country at the present time. It is disappointing, discouraging, and it is feared will not be realized or believed until much valuable time shall elapse, not until we are forced to believe and appreciate it as we were forced to realize that our present forests must be preserved.

What then? Has a like condition ever existed and been met by a civilized people? If so, what did that people do? Furthermore if anything was undertaken was it successful? The answer to these reasonable questions is: Quite similar conditions have been met by European countries and the problem has been successfully solved. It has been done, and the work is still being vigorously carried on, by planting seeds where the trees are to grow in the forest, or, more generally, by growing trees in the nursery and, when from one to four years old, transplanting them into the forest. Germany, France, Austria, Italy, Belgium, and Switzerland are more or less extensively engaged in it. Germany and France especially so, and find it profitable. The annual net profits of German forests run from $1.60 to $5.35 per acre.

But it objected that planting trees costs money. True it is that it does cost money, but what will the result be? On one side of the ledger is natural reforestation, with long and indefinite lapse of time, where there is any stand at all, before any return; and no return whatever where all vegetation is killed and the soil is eroded beyond recovery. On the other hand is artificial restoration in seventy-five to one hundred years or less, according to the uses the timber is to be put to, with a full crop of valuable timber trees. Can there be any question as to which would be the more profitable?

Then comes the question, who will do this planting? "The State, of course," is the answer many will give. Let us see about that. Is it desirable that the State should own practically all the timber of the future? Could the State secure approximately all the non-agricultural lands within its borders if it were advisable that it should? There are over eight million acres of such land in Pennsylvania. A considerable portion of it lies in large tracts, but there is hardly a farm in the State but that has more or less of it. Possibly the State may secure twenty-five per cent. of it, may be more. But who is to reforest what the State cannot? It must be done by the owners or not at all. Now, if the conditions were alike there is

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more reason why the State should engage in tree growing than in wheat growing. But the conditions are not alike, for the element of time so enters into it that the State should bear a share of the burden. However, it should by no means be expected to do it all, nor can it. But if it could, who can guess what the speculator, the politician and the grafter would do?

Somehow many look upon growing trees in a nursery and transplanting them into the forest as a profound, mysterious work, accompanied with great labor and risk, when, in fact it is simple, easily understood, and not laborious. He who sets out fruit trees may have in his mind the labor and cost of that work and may judge the cost of planting forest trees from that. Growing forest trees in a nursery is no more difficult than growing any common garden vegetable. They are transplanted when not over four years old. Two men and a boy can set out an acre a day, under ordinary conditions, and the loss should not exceed five per cent. If the State should furnish the seedlings gratis and a forest expert to oversee the work, as is done in France and Canada, and as I believe we should do, the only cost would be that of setting out the trees as indicated.

The farmer should have his wood lot to furnish his fuel and wood for other uses on his farm. It can stand on ground worthless for other purposes, land which otherwise would bring him nothing. But it is admitted that no one in our State can afford to plant trees under our present tax laws, laws that were passed when it was desirable to get rid of the forests instead of growing and preserving them as now, and when the conditions were the very reverse from what now exist. All this must be changed and no heavier tax be assessed upon lands on which immature forest trees are growing and being cared for under legal regulation until such trees mature, than the naked land should bear. We do not tax young cattle or colts until they are four years old, until they mature, and the same principle should apply to immature trees. Neither do we put an extra tax on a piece of ground because wheat is growing upon it. No prospective value for the purposes of taxation should be put upon the trees, for that value may never materalize. Disease, winds or fire may destoy them.

With our tax laws modified, and trees furnished gratis by the State, under proper regulations and conditions, there is no good reason why the land owners of our State should not engage in the good work of upholding the prosperity of the Commonwealth and performing a sacred duty towards posterity. If it shall not be done much of our land will become a barren waste the same as other regions where the forests have been destroyed and nothing done to restore them.

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SHOULD DEER FARMING BE LEGALIZED IN PENNSYLVANIA?

DR. J. T. ROTHROCK, Member State Forestry Reservation Commission.

Production and care of game has always been regarded in countries where forestry is an established science, as a legitimate portion of forestry work; in fact, in some countries, forestry has been simply the outgrowth of hunting interests.

In view of the fact that this country is now paying an excessive price for meat, and that there seems to be no probability that it can ever become much cheaper; in view also of the fact that deer farming could, under proper legislation, be made a profitable industry, and at the same time be made to furnish an acceptable meat at a cheaper price than is now possible with our ordinary domestic animals if suitable legislation were had, it is suggested that it is worth while to consider this question in our report.

All of our domestic animals came to us from a wild condition. There is no evidence whatever that any one of them was not originally wild. All were brought under domestic control by years of patient labor. As the law now stands, it is impossible for any citizen of this State to go into any other State and purchase deer there, or here, which were bred in captivity and bring them into this State, feed them as domestic animals, and kill them and dispose of them with the same freedom that he now does with other domestic animals. There is no more reason why such a prohibition as this should exist than there would be to prevent a man from raising and selling a turkey upon his own ground. The only argument that has been adduced in favor of the existing law which prevents us from raising and selling venison just as we do beef, is that all game belongs to the State. In such a case as I have cited this is false, and no legal decision can alter the fact that deer bred in capitivity in another State or in Pennsylvania never did belong to this State, and by no legal fiction should be considered as belonging to it. To assert that allowing deer farming to exist as a legitimate, unhindered business would open the way for the sale of deer taken in the wild condition from the forests of the State and therefore should not be legalized, is to make a great interest subordinate to a very small one.

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PLATE XII. Seventy-Five Year Old Second Growth White Pine at Base of Mount Tom, Tioga County.

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The Game Commission of the State exists for the purpose of protecting our native game, and such a law as would permit an unhampered system of deer farming under such conditions as would render it profitable would not in the least degree interfere with the work of the Game Commission.

It is therefore suggested that the time is ripe for legislation upon this subject.

That deer farming can be made both possible and profitable would appear from the following:

The Otzinachson Rod and Gun Club owns four thousand acres of land on Rattlesnake Run, in Clinton county. In May, 1899, there were purchased and placed in the enclosure thirty deer. There were subsequently added fifty-five more. From these and from the increase the club members have annually killed a considerable number. It is estimated that between eight hundred and one thousand deer remain in the enclosure.

It would appear to be evident that care and feed of deer would cost less than of cattle, and it is therefore quite probable that the meat could be sold more cheaply than either beef or mutton.

A BRIEF CHAPTER IN FOREST HISTORY.

HON. S. B. ELLIOTT, Member State Forestry Reservation Commission.

The great length of time required to grow forest trees for lumber from seed is, without question, the reason why so little work is undertaken in this line. Immediate results are sought in most business ventures. A man does not seek to engage in an enterprise in which he cannot see some probability of attaining the end sought during his life time, and the more remote this probability appears the less inducement does he feel to embark in it. However, there is frequently a misapprehension of the time required for reaping the reward of his labor, and this is, no doubt, the case in growing trees for the various purposes to which wood is put. To modify a belief that the time required is so long as practically to prohibit any effort in that line, the following history of a small white pine forest is given:

It must have been about the year 1829 that a stand of virgin white pine, some twenty or thirty rods wide and about twice as long, was cut along the base of Mount Tom, at the confluence of

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Pine and Marsh Creeks, Tioga county, Pa. The location was then known as Big Meadows, but is now called Ansonia. The land where these virgin pines were cut was cleared and used as a pasture. Many were left bordering the upper side of the field and in 1831, or, possibly 1832, these bore seed and the winds scattered it on and over the cleared ground, and, of course, most of the seed fell adjacent to the trees. Coming in contact with the mineral soil of the field the seed readily germinated and in a few years a dense growth of small pine trees was the result.

In the fall of 1841 two boys, one of them eleven years old, played among this grove and as they held their arms out horizontally the tops of the little pines would just touch them. Probably the trees were about the same age as the eleven year old boy. Time passed on and what were little trees in 1841 were tall pines in 1906, some of them ninety feet high and eighteen inches in diameter. Few were less than fourteen inches. In a large portion of the stand the trees were so close together that after they were fifteen or twenty years old there was a struggle, not only for supremacy but for existence, and many of them died in consequence. This weakened the survivors and they were unable to make so good a growth as they would have done had the superfluous trees been removed at the proper time, in accord with forestry practice. The surviving trees were robbed of food and moisture which a removal of the superfluous trees at the proper time would have given them. Hence there was not so full a development of all the trees as would have re-resulted if proper thinning had been made by man. But still this severe crowding had its virtues. The lower limbs of the survivors were deprived of light, died, and dropped off giving tall, smooth, clean stems for timber. Yet better results could have been obtained by removal of the superfluous trees at the proper time, thus avoiding the exhaustion of a prolonged struggle with these weaker ones

The survivors were cut for lumber in 1906 and most of them yielded three logs, and some of them four, for the sawmill. Such parts as were not large enough for the sawmill were cut into lath. The stumps, cut about one foot above ground, showed seventy annual rings of growth. Now, a white pine seedling generally reaches that height in the first five years of its life. Add these five years to the seventy shown by the annual rings and we have seventy-five years as the age of the trees, which corroborates the estimate of the time, 1831, when the seeds were sown. The accompanying photographs add what it would be difficult or quite impossible to give without them.

One of the illustrations shows Mount Tom, along the base of which and just back of the houses near the foot of the slope, is where the

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PLATE XIII. End View of Thirteen-Inch Board Cut from Second Growth White Pine Shown in Plate XII.

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little forest stood. It also shows the result of modern methods of lumbering, practically the destruction of all valuable growth. Only small stuff is left. There are no valuable species remaining for seed. If a second growth shall spring up, a doubtful event, it will have no value except to prevent erosion of the soil.

Another of the photographs shows a part of the stand, by no means the best, which demonstrates the effect of dense growth in early life, tall straight stems in which nearly all the wood grown has been deposited.

The remaining illustration is from a section of a board cut from one of the trees. The board was sixteen feet long without wane with only a trifle of sap at the upper end, and as will be seen, is thirteen inches wide. There are thirty-five annual rings shown in it, all heartwood, and the width of these at the outer edge indicates that there was a struggle for food going on at the time, for they are much thinner. Relief through the removal of superfluous trees at the proper time would have greatly increased the thickness of the outer rings.

So-called second growth white pine lumber is generally considered far inferior to that cut from old forest trees, and this is true as we now know such lumber. But it must be admitted that the new growth is of the same species as the old. It springs from seed grown on the old trees. Why, then, the difference? It lies in the fact that the old trees grew in the crowded forest and lost their lower limbs in early life; and this, combined with age, brought about the excellent product which we so much esteem. German forests of our white pine one hundred to one hundred and twenty years old prove this, and, to a considerable extent, the case in hand does. The lumber from these tall trees was of much better quality that that cut from trees grown in the open.

Here on the foot of Mount Tom have been harvested two forests from the same ground within eighty years, probably seventy-eight and man gave no aid in hastening or bettering either. With care in planting so as to secure an even stand and thinning at the proper time, the yield of the last growth would have been greater and of better quality. As it was, the yield was said to have been over twenty thousand board feet to the acre, worth, on the stump, not less than fifteen dollars per thousand. If the present generation cannot provide forests for itself it can for that which is soon to succeed it.

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IS THE PRODUCTION OF CHESTNUT FRUIT A PROPER FUNCTION OF STATE FORESTRY?

December 24th, 1907.

J. T. Rothrock, M. D.,
Consulting Forester,
West Chester, Pa.

Sir: Will you kindly give me your opinion as to whether or not the production of chestnut fruit is a proper function of State Forestry.

Yours truly,
ROBERT S. CONKLIN,
Commissioner of Forestry.

December 25th, 1907.

Hon. Robert S. Conklin,
Commissioner of Forestry:

Dear Sir: In reply to your favor of the 24th inst., I offer the following:

Is production of chestnut (fruit) a proper function of State Forestry?

That enormous possibilities as a food producer and as a profitable industry exist in the chestnut cannot be doubted. Its long established culture in the Old World, and its long list of utilities there simply show what can be done here, and we may add, they show in some measure what will be done here, as population increases and as pressure for food becomes more severe.

While the Forestry interests were associated with the State Department of Agriculture, considerable attention was given to this question and my efforts therein culminated in an article printed in the first report of this Department. (See Report for 1901-02). Not only were the methods of chestnut production discussed, but information was published by the writer as to methods of chestnut meal production, in hopes that it might lead some enterprising citizens to undertake to furnish as a home production what is now annually purchased abroad and imported to us.

The State Department of Agriculture has wisely given further attention to it within more recent years. In 1904 the State Department of Agriculture printed (as Bulletin No. 123) an elaborate account by Professor Nelson F. Davis, of the chestnut grove of Mr. C. K. Sober in Northumberland county, Pa.

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There is no doubt that chestnut culture can be made remunerative here, and on ground which is quite too rough for the common cereal grains.

This brings us to the question frequently asked, why does not the State Forestry Department take the initiative in the production of this fruit and utilize the rougher ridges for this purpose? It is quite sure that it could do so successfully. It may be well here to inquire what the legitimate function of the Forestry Department is. Briefly it may be said to be, to do for the Commonwealth at large what the citizen cannot do for it and in addition thereto to aid and instruct the citizen in doing for the Commonwealth what he ought to do for it and is unlikely to do without State aid. In other words, the Department of Forestry may be reasonably expected to assist the Commonwealth and the citizen, but not to deprive the latter of his chance for remunerative work by competition with him.

It is for the Forestry Department to acquire lands by purchase, to protect them from fire and trespass, and as rapidly as possible to cover them again with timber. To this we may add that it might fairly be considered a function of the Department to produce and supply seedling forest trees at cost to those who could give a reasonable assurance that they would be properly planted and cared for. The attempt to do these things will exhaust the appropriation entirely and still leave undone a large amount of work which properly belongs to the Forestry Department.

Now on the other hand chestnut culture can be conducted on the wood lot of almost any farm, and made profitable. It requires almost no outlay to begin it. Those who have been most successful have proceeded as if it were a species of orchard work. Cleanliness of the ground, if not absolutely required, is certainly much in favor of regular crops. The litter of the forest conduces to bad fruit and irregular crops. There is no more reason why the Forestry Department should compete with the farmer in the production of chestnuts than there is that it should compete with him in production of apples, potatoes, wheat, or corn. The same reason exists against the State becoming the farmers' competitor in the one case as in the other. It would be doing what the citizen can and should do, and be depriving him by an unjust competition, of rewards which belong to him.

The demand for chestnuts is not at all likely to be large in this country for many years, and it is entirely within the power of the citizen farmer to supply it.

Chestnut culture then appears to be a branch of Agriculture rather than of Forestry, and the State Department of Agriculture

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merits commendation for the encouagement which it is lending to the work. The State Forestry Department aims to assist rather than to compete with the citizen in an enterprise which shall be entirely his own.

Very truly yours,

J. T. ROTHROCK,
Consulting Forester.

THE PLANTING OF TREES IN STREETS.

I. C. WILLIAMS, Esq., Deputy Commissioner of Forestry.

While the subject of street tree planting is rather collateral to the science and practice of forestry, yet every forester, by reason of his intimate relationship with trees generally, is perforce a lover of the individual tree, and especially of trees when properly planted along streets and highways. He is equally interested in seeing such trees accorded the treatment and protection which they deserve.

The subject of street tree planting is being more widely thought about in Pennsylvania at this time than ever before. Societies are being formed for the purpose of the study of street trees, and then to carry into execution the principles upon which their organizations are founded. It is being referred to by teachers in our elementary schools, and the introduction of the school garden is bringing to the attention of pupils, tree life, tree planting, and street adornment in a manner both forcible and correct.

It is a fact too well known for comment that the scientifically or artistically built city in America is most conspicuous by its absence; that a few straggling houses gradually grew into a village, and streets were opened without regard to width, future use, or location; that the village grew into a borough and later into a city with such established characteristics that it is now next to impossible to make a change. In America, where land is so abundant, and was formerly so cheap, no well founded excuse can be offered for narrow streets. In many cases our streets are but narrow lanes with houses built to the very line of the sidewalk and these latter narrow and paved to the curb, no thought whatever having been given to the general unhealthfulness of such building nor to the idea that at some time it might be desirable to have the street planted with well selected trees.

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PLATE XIV. Tree Appreciation. Ideal City Streeet Planting Inside of Sidewalk.

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Tree planting on such a street is well nigh impossible of success. For this reason our city streets are bleak and unattractive, except for architectural effort, and wonder is sometimes aroused why persons should be content to live in such localities; why they never think of seeking a home adorned with green sward and beautiful shade trees, away from sunbaked highways, and which, from a money point of view, would be less costly than the former method of life?

An attempt was made in Pennsylvania by the Legislature of 1901 (See Act 17th June, P. L. 569), to encourage the planting of shade trees along public streets, and gave to the boroughs of the Commonwealth authority to require or compel such planting; and in case of refusal of the owner to plant trees, that they should be planted by the municipality and the cost thereof collected from the owner. This legislation has not brought results. Such an innovation as planting trees in streets where none ever existed before was too great a strain for the average councilman, for by exerting this authority he could see his personal popularity rapidly waning and thoughts of defeat at the next election were constantly haunting his dreams.

So street planting in Pennsylvania, by means of direct municipal ordinance, under this legislation is unsuccessful, and will likely continue to be so unless a great and unlooked for civic awakening should suddenly lay hold of borough and city government. The act remains upon the statute book, but certainly to no purpose.

The same year another statute was approved (See Act 2nd July, 1901, P. L. 610) which had for its purpose encouraging the planting of roadside trees throughout the country generally, the inducement being a tax abatement to those who should plant and protect the trees. The amount of tax to be abated is not to be in excess of one-fourth of the whole road tax levied, and in addition, the owner is required to protect the trees. This means that if the trees are planted within the lines of fence the owner must surround them by suitable tree guards if the field be ever devoted to grazing purposes, as most farmers' fields in Pennsylvania are, in turn. If the trees should be planted outside of the fence along the highway, he would have additional troubles, for trees in such locality are generally looked upon as any man's property, and subject to the whim of every passerby. Then again, the rebate of taxes amounted to only fifty cents per tree, a sum scarcely sufficient to purchase the tree and pay for the guard around it. When it is considered that this rebate or "inducement" is to be allowed but once, we may readily understand that the Act in reality furnished little encouragement to those who would plant trees for material advantage

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only, and not for the sake of the trees themselves or the beauty of the community.

This legislation has occasionally been taken advantage of, and we find here and there over the State some excellent rows of wayside trees, some of them planted by reason of the "inducement" given by the law; but by far the greater number of them because the owners love trees and have an inborn aesthetic desire to enjoy life with beautiful surroundings rather than be content to exist in the barest and most meager manner.

Furthermore, the tax abatement idea is neither popular nor practical in the way it has been attempted to be employed. It is unpopular, because tax officials do not or will not try to understand it, and because it imposes upon them additional work; and it is impractical because it makes more cumbersome a system already sufficiently complicated. Latterly, the whole system of tax rebate for tree planting or tree growing has been declared unconstitutional. (See Tubbs vs. Tioga Township, 32 County Court Reports, page 504). Therefore, it becomes necessary to take the planting and maintenance of street shade trees out of the hands of borough and city councilmen and place this duty either into the hands of a commission whose members would serve without pay, and whose term of office should be sufficiently long that they would not be disturbed by each councilmanic re-organization, and who would not be constantly grooming themselves for re-election, or some other system must be devised.

The legislature of this State, in an act approved May 31st, 1907, P. L. 349, has attempted to provide a system whereby townships of the first class, boroughs, and cities of the Commonwealth may have and enjoy something approaching systematic tree planting. The act, which is comprehensive in nature, and some of the provision of which have been found useful in other states, is, in full, as follows:

No. 251.

AN ACT

To provide for the planting and care of shade-trees, on highways of townships of the first class, boroughs, and cities of the Commonwealth of Pennsylvania, and providing for the cost thereof.

Shade-trees.

Section 1. Be it enacted, &c., That in townships of the first class, boroughs, and cities of the Commonwealth of Pennsylvania there may be appointed, in the manner hereinafter provided, a Commission of three freeholders, to be known and designated as the Shade-

Shade-tree Commission.

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tree Commission of the said township, borough, or city, who shall serve without compensation, and who shall have exclusive and absolute custody and control of, and power to plant, set out, remove, maintain, protect, and care for, shade-trees, on any of the public highways of the said townships, boroughs, and cities, the cost thereof to be provided for in the manner hereinafter stated: Provided, That in townships, boroughs, or cities in which a Commission for the care of public parks shall have been created, said Commission shall, upon the acceptance of this act as provided in section two, be charged with the duties of the Commission as above provided, and shall, for that purpose, be possessed of all the powers herein mentioned and granted.

Proviso.

Existing park commissions.

Section 2. The commissioners of any township of the first class, or the councils of any borough or city, in the State of Pennsylvania, may, by majority vote in the case of the commisioners, or by joint resolution in the case of the councils, accept the provisions of this act; and when such majority vote or joint resolution shall have been duly passed and approved, and such Shade-tree Commissioners appointed, or, in their stead, the duties and powers herein provided have been devolved upon an existing park commission, then, from that time and in that event, this act and all its provisions shall be in full force and application in such township of the first class, borough, or city, so accepting; and such commissioners shall be be appointed, for terms of three, four, and five years, respectively, and, on the expiration of any term, the new appointment shall be for five years, and any vacancies shall be filled for the unexpired term only; and in townships of the first class the said appointment shall be made by the commissioners thereof; and in boroughs, by the chief burgess and in cities, by the mayor thereof: Provided, That in cities where a Commisison exists for the care of public parks, the term and appointment of such Commission shall not be changed by this act, but shall be and remain as provided by the act of Assembly, and by the ordinance of councils creating such Commission for the care and maintenance of public parks. And such Shade-tree Commission shall, twice in every year, report in full

Acceptance of this act.

Terms of commissioners.

Appointments.

Proviso.

Annual report.

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its transactions and expenditures for the municipal fiscal year then last ended, to the authority under and by which it was appointed: Provided, That an existing park commission, acting under this enactment, may embody its report in its regular report to the councils, as by law or ordinance provided.

Proviso.

Tree planting, etc.

Section 3. That when such shade-tree commissioners, or park commissioners so acting, shall propose the setting out or planting or removing of any shade-trees, or the material changing of the same in any highway, they shall give public notice of the time and place appointed for the meeting at which such contemplated work is to be considered, specifying in detail the highways, or portion thereof, upon which trees are proposed to be planted, removed, or changed, in one or more—not exceeding two in all—of the newspapers published in said township, borough, or city, once each week for at least two weeks, prior to the date of said meeting.

Notice shall be published.

Cost of planting, transplanting, etc.

Section 4. The cost of planting, transplanting, or removing any trees in any highway, and of suitable guards, curbing, or grating for the protection thereof, when necessary, and of the proper replacing of any pavement or sidewalk necessarily disturbed in the doing of such work, shall be borne by the owner of the real estate in front of which such trees are planted, set out, or removed; and the cost thereof as to each tract of real estate shall be certified by the commisisoners to the township commissioners, or to the presidents of the councils in boroughs and cities, and also to the person having charge of the collection of taxes for the said township, borough, or city; and upon the filing of said certificates, the amount of the cost of such improvement, of which notice shall also be given to each property owner involved, accompanied with a copy of the aforesaid certificate, together with a notice of the time and place for payment, shall be and become a lien upon said real estate, in front of which said trees have been planted, set out, or removed; said lien to be collectible, if not paid in accordance with notice as herein provided, in the same manner as other liens for taxes are now collectible against the property involved.

Certificates.

Lien.

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PLATE XV. Street Tree Butchery. The Perfected Work of the "Professional" Tree Trimmer.

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Section 5. The cost and expense of caring for said trees after having been planted or set out, and the expense of publishing the notices provided for in section three, shall be borne and paid for by a general tax to be levied annually in the manner that taxes for township, borough, and city purposes are now levied in such townships of the first class, borough, or cities; such tax not to exceed the sum of one-tenth of one mill on the dollar on the assessed valuation of the property in such townships of the first class, boroughs, or cities; and the needed amount shall each year, in due time, be certified by the shade-tree commissioners to the proper authorities charged with the assessment of taxes in said townships, boroughs, or cities, to be assessed and paid, as other taxes are assessed and paid, and to be drawn against as required by said commissioners, in the same manner as moneys appropriated for township, borough, or city purposes, are now drawn against in said townships, boroughs, or cities: Provided, That the commissioners of any township of the first class, and the councils of any borough or city, accepting the provisions of this act, may provide for the expense of the maintenance of trees on highways, in accordance with the provisions of this section by actual appropriation, equal to the amount certified to be required by the said Commission, in lieu of the specific assessment above authorized.

Costs of care and publication.

Tax.

Proviso.

Appropriation.

Section 6. The Commission, under which the provisions of this act shall be carried out, in any township of the first class, borough or city, shall have power to employ and pay such superintendents, engineers, foresters, tree-wardens, or other assistants, as the proper performance of the duties devolving upon it shall require; and to make, publish and enforce regulations for the care of, and to prevent injury to, the trees on the highways of any township, borough, or city accepting the provisions of this act; and to assess suitable fines and penalties for violations of this act, provided such regulations shall have been published at least twice in one or more, not exceeding two, newspapers of the township, borough, or city, involved, after having been submitted to and being approved by the commissioners of the township of the

Superintendent, engineer, wardens, etc.

Regulations.

Fines and penalties.

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first class, or the councils of the borough or city affected; and such fines and penalties, so assessed for violations of this act, shall become liens upon the real property of the offender, and be collectible by the constituted authorities as liens for taxes upon real property are now collected.

Liens.

Disposition of fines, etc.

Section 7. All the moneys due and collected from fines or penalties or assessments, in consequence of the acts of said Shade-tree Commission in enforcing this act, shall be paid to the treasurers of the townships, boroughs, and cities accepting its provisions, and shall be placed to the credit of said Commission, subject to be drawn upon by the said Commission for the purposes of this act.

Repeal.

Section 8. All acts and parts of acts inconsistent with this act are hereby repealed.

Section 9. This act shall take effect immediately; but its provisions shall not be and become binding upon any township, borough, or city until it has been duly accepted, as provided in section two.

Approved—The 31st day of May, A. D. 1907.

EDWIN S. STUART.

Most persons who are at all familiar with street planting are agreed that street trees should be planted, maintained, and protected by the municipal authorities. Without uniformity of plan, selection of species, or method of planting, the greatest variety of tree planting in each street is likely to result. Possibly no two owners along a street would select the same species. Cheap, undersirable trees are more likely to be planted than those best fitted for the soil and width of the street. Protection from insect enemies cannot be so well secured with in dividual planting nor can trees be so well protected from other injuries that constantly threaten them in streets. Under a systematic plan they would more likely be placed in better position for full development, be uniform, and not subject to the whim and caprice of changing owners. It is conceded that street paving, street curbing, and street improvement generally are proper functions for municipal government. It is equally true that the planting and care of shade trees is just as much a governmental function.

Col. Wm. F. Fox, New York State Superintendent of Forests, has written as follows concerning the value of street trees:

"Tree planting is one of the best expressions of altruism. The man who plants trees is thinking of others rather than himself. He

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enables people to gratify their love of the beautiful, to enjoy better health, to become more prosperous; he makes the world better and happier.

"Trees purify and cool the air, increase the value of surrounding property, and are pleasing to the eye. They should be placed along the highways, on our village and city streets, on lawns and in parks, on school house grounds, on the farm, in the dooryard, and wherever shade or shelter may be needed. Planted in commemoration of persons or events, they become living monuments that endure when the inscriptions on the yellow, moss-covered marbles of the churchyard are no longer legible."

There are those who will argue that streets should not be planted with trees because they keep the surface of the roadbed damp and muddy by reason of the shade. With a poor street or road this may be true in part, but with a road properly constructed it cannot be and is not true. A muddy road is not so because of the trees' fault. A well constructed road or street lined with a double row of trees is not only not more damp or muddy than similar streets not so protected, but has the added advantage of not having the roadbed ground up into a mass of thick stifling dust, which is invariably the case with the sun-baked highway. The dust of our summer roads is almost as bad as their depth of mud in winter. It is possible to remove both of these nuisances, and neither of them is contributed to by the roadside trees.

Pennsylvania is entering upon an era of good roads. Her appropriations for this purpose are now reaching millions of dollars a year. Some of the improved State roads have cost as much as $10,000.00 per mile. They could be greatly adorned and made attractive to public travel if well planted on each side with suitable shade trees. This fact has been recognized by the legislature in the reorganization of the Highway Department by the Act of June 8, 1907, P. L. 515, wherein it is provided in section twenty, as follows:

"The State Highway Commissioner may also cause trees to be planted along such State highways, the same to be paid for as part of the cost of the road, but to remain the property of the State."

Under this authority, the State Highway Commissioner is planting his roads with suitable trees, and it is the hope of those interested that tree planting along improved State Highways will shortly become as much a part of road improvement as other necessary parts of the work.

In order to derive best results from street and roadside planting special care must be had in the selection of the trees. Some trees will de well in one kind of soil, while others will not. Some are too large for the width of the street to be planted. When fully de-

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veloped they cause considerable trouble by interference. Some trees should be avoided because of insect pests which constantly attack them, others because they shed their foliage early, or are otherwise objectionable. The insect enemies of trees can in part be combatted by an organized municipal Tree Commission, but none of the inherent specific objections can thus be overcome. Certain trees form their crowns too low, while the lack of wood strength in others is such that when planted alone they are unable to withstand the strong winds and the burden of snow and sleet which are fatal to many of our soft wood street trees.

Trees suitable for wide streets are not suitable for narrow streets and vice versa. The mature tree specimen should always be kept in view when planting, so that proper space for development of its crown may be provided and proper distance allowed between each two trees. The crowns should not interfere and ultimately destroy each other.

The following twelve species of trees are recommended for street planting in Pennsylvania. The first six are suitable for wide streets, while the last six are best suited for narrow streets. Trees suitable for wide streets are the American elm, sugar maple, American linden, sweet gum, scarlet oak, and red oak. The trees suitable for narrow streets are Norway maple, red maple, cucumber tree, ginkgo, pin oak, and hardy catalpa.

The American elm certainly stands at the head of all American trees for planting upon a wide street or in all open places where ample opportunity may be given for the development of the natural symmetry of the tree. It grows rapidly and bears transplanting well. Several shapes of the tree are so well recognized that they have become standard types of this particular species. This tree in Pennsylvania is generally free from insect troubles, although there are localities where the elm leaf beetle makes its attacks. As hereinbefore stated, all external insects depredations may be successfully combatted where there is an organized system of tree protection carried on by those skilled in the work.

The sugar maple, some times called the hard maple, is one of our most beautiful and symmetrical trees. Grown in the forest it attains large proportions, with crown high in the air and trunk developed into a great thickness throughout almost the length of the stem; but when planted alone in streets or lawns it assumes a rounded crown form carried well into the air, although not attaining the height of the American elm. This tree is signally free from the attack of insects. Its light green, rather dense crown, affords a grateful shade, and the highly tinted leaves of autumn are carried well along toward the winter season. It has been noticed in some

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PLATE XVI. Tree Appreciation. Ideal City Street Tree Planting Along Curb.

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localities where there is an excess of gas, smoke, or dust in the air, that the sugar maple has suffered therefrom, neither does it do so well on streets completely covered with paving and sidewalk. It should have a reasonable amount of uncovered ground in which to spreads its roots, and should succeed well where planted inside the sidewalk, with houses well set back.

The American linden, one of our best known trees, is entirely suitable for wide street planting. It forms a heavy, well rounded crown, its foliage is attractive, and its immense quantity of fragrant flowers are especially pleasant when contrasted with the dark green upper surface of the leaves. The stem of the linden rapidly dissolves into its expanded crown, so that the tree when planted openly makes only a moderate height growth, with wide reaching branches. The linden is graceful in habit, and should be more frequently planted in America, as it is in Europe where its value as a street tree is well recognized.

The sweet gum is a tree which easily attains a height of fifty feet, with a corresponding diameter of crown. It is especially interesting because of the novelty of its foliage, the character of its fruit vessels and the resinous fragrant balsam which sometimes escapes from wounds. While this tree is distinctively southern in its habits, it grows well in parks throughout Pennsylvania and New York, and other places of equal latitude, and should succeed well as a general street or roadside tree in this State. The color of the leaves in autumn is one of its most striking features. The tints vary from light lemon yellow through deepening shades to most brilliant scarlet. This color play when compared with nearby objects is most pleasing. Some of the best examples of color effect with the sweet gum tree are to be seen near Wallingford, Delaware county, this State.

The scarlet oak and red oak are regarded suitable street trees because they are clean in habit, reach a moderate size, and possess perennial charm, whether with or without foliage. The color play of the leaves of the scarlet oak and the red oak is so well known that no description is necessary. The trees are rather free from insect enemies and are the most rapid growers among the oaks.

All the preceding are native American trees, and this should have at least some consideration when selecting to plant for shade or ornament. There are so many good trees in America that it is folly to go about over the world in search of rare or little known trees, unless simply for their novelty, and then to have them at times succeed poorly because far removed from their native environment.

Of the trees suitable for planting in narrow streets, possibly the best is the Norway maple. While this tree is not a native of

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America, it has become so well known here by general adoption that we regard it with almost equal consideration. It certainly is a noble, valuable tree for close planting on narrow streets. Its dark green dense crown, well rounded and shapely, is attractive, while its pleasantly colored yellow tinted leaves are among the last to fall with the approach of winter. This tree is free from insect enemies, keeps its roots well below the surface of the soil, and succeeds under pavements laid with brick or sheet asphalt.

The red maple, a native of America, is classed with the soft maples, is rapid in growth, and shows an interesting play of colors in its foliage. The change of color begins sometimes as early as the middle of July, and runs through the yellows, browns, scarlets and crimsons until the fall of the leaf. When tossed by the wind the bluish white undersurface of the leaf is especially noticeable in contract with the color of the upper side. The tree does not reach large size generally, and may be used with good effect where but little space may be given to tree planting.

The cucumber tree, one of the magnolias and a native of Pennsylvania, is little known as a shade or street tree. The crown reaches a considerable height when planted alone, is cone shaped in outline, and carries a heavy foliage of rich green large sized leaves. The bloom of the cucumber tree is attractive and fills the air with a penetrating odor, followed later by the cucumber shaped fruit.

The ginkgo tree, a native of Japan, is best suited where there is the least possible space for tree planting. In this respect it much resembles the Lombardy poplar, tall and narrow in outline, and will fit itself into many spaces where no other tree could be employed. It is free from insect pests, and its olive green leaves resemble the pinnae of the maidenhair fern. It is often called the maidenhair fern tree for this reason. The leaves acquire a rich yellow tint in autumn. The tree occasionally develops fruit which resembles yellow plums, but has a stone more in shape like the pit of a peach. The fruit is not frequently set in this country. While it resembles an ordinary broad leaf tree, it is really a conifer, a member of the yew family, a fact not generally known. This tree affords a very thin shade.

The pin oak thrives well in moist ground. Its limbs naturally have a trailing habit, but the tree may be trained to carry its crown well up. In narrow streets and roads it may be used as a suitable shade tree. The leaves of the pin oak are deeply lobed, the crown is not dense, the bark in the young tree is of a gray green color, and the whole plant is usually free from insects and fungus diseases. It is especially fine as a lawn tree, where its lowest branches are

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longest and trail upon the ground. Grass will grow under it by reason of the light airy character of the crown. Its leaves are always well colored and cling to a late date. Its roots are not troublesome under sidewalks or curbing and the tree is of rather rapid growth.

The hardy catalpa is a native of the middle Mississippi Valley, and is being gradually introduced into Pennsylvania. The tree differs greatly from the common eastern or southern catalpa. It carries a straight stem throughout its crown, and does not dissolve into a mass of crooked, sprawling branches as is the habit of the common catalpa. In leaf and flower it resembles the latter, but is a better tree in every respect. It is well worth a trial in our streets and along roadsides, especially where the roots may find an abundance of soft, loamy soil. The wood of this tree is valuable, while the wood of the common catalpa, except for firewood, is almost valueless. Along with the common catalpa it is subject to attacks of the catalpa worm, but a proper system of spraying once or twice a year will destroy this pest. The tree is worth the extra touble.

There are other native American trees well adapted for both wide and narrow streets, but the above few species will probably do best under all the circumstances and conditions which are likely to surround street and roadside planting.

Having called attention to the above desirable species of trees, it might be well to name a few that are not well adapted for street or roadside planting.

Coniferous trees generally, are not suitable for this purpose. They do well for landscape work or lawn grouping, but as street shade trees are not desirable. The ginkgo is an exception.

The Carolina poplar or cottonwood, is not a good street tree. Its wood is too soft, and it loses its leaves too early in the season. The roots throw up ridges under sidewalks and displace curbing. They will enter sewers and drain pipes, and cause trouble there. The tree is short lived and the wood of little value. This tree, because of its rapid growth, is one of the most commonly planted trees. While the leaves are young and resinous and during the early summer, it is a pleasing tree; but there are so many other species better that it may well be displaced by them.

The negundo or ash leaved maple and the white maple, are not desirable street trees. The trunk of the white maple soon divides into long, heavy limbs, set at such an angle, that a splitting of the trunk frequently results, when extra weight is added, or when tossed by the winds. In its native haunts along river banks and in meadows, it is seen to its best advantage. By reason of its strong, upward growth, this tree and the Carolina poplar seem to be the best subjects upon which to ply the art of the itinerant tree trimmer.

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Examples of this practice are so numerous about us that we may well wish the trees superseded by other species, if for no other reason than to avoid these unsightly appearances.

There are those who advocate the pruning of trees, as well as those who contend that the less pruning done the better. Certain it seems that reasonable pruning in particular instances may be well employed. This is true in case of removal of dead limbs, where damage has resulted from storms and sleet, or where it is necessary to raise the crown of a tree by removing lower branches; but the general, promiscuous, unskillful mutilation of trees, commonly called pruning, should no more have place in the life of a tree than it should in the life of a man. Men are fitted by nature to grow into certain sizes and shapes, and no amount of trimming or pruning, or anything in the nature thereof, will ever make them anything else. Nature has designed her trees to grow into certain sizes and shapes, and any attempt to alter her course generally means failure, as well as the turning of seemly natural objects into horrible monstrosities. All necessary tree pruning should be done by experienced men who understand tree life and tree necessities, who go about their duty with intelligence, and who can assist nature rather than interfere with her processes. Promiscous pruning by promiscuous pruners, such as we are acquainted with, almost invariably results in the death of the tree operated upon. How necessary, therefore, that this work be done in a way which will produce beneficial results rather than do permanent harm. A proper estimation of the ordinary tree trimmer is found in a paper by Benj. W. Douglass, contained in the Fifth Annual Report of the State Board of Forestry of Indiana. His characterization is here so apt and so distinctly true that the following paragraphs are quoted:

"Against our present day tree trimmers too much cannot be said. The vast majority of them are utterly ignorant of the subject and no more eloquent condemnation of their work could be written than is to be seen in the dead and dying examples of their butchery which line our streets. These tree butchers are often ordinary vagrants who secure some implement that will cut wood, and for a season in spring and fall they set up for tree trimmers. Often I have seen such professionals who did not even own their own tools and expected to borrow a saw and hatchet from their "clients."

"A little farther up the scale is the permanent or resident tree trimmer, who has an outfit of tools, including a pair of sharp-pointed "climbers," with which he ascends the tree as easily as a lineman does a telegraph pole, often tearing great gashes in the bark, but always damaging the tree to a considerable extent. This class, while better equipped for their destructive work, are no more to be

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reasoned with than are their more primitive brethern, the "vagrant professionals." They all hoot at the scientist and invariably proclaim that "nature is their teacher." If such is the case, they have fully demonstrated their incapacity for learning. In their ignorance they cannot realize that "science is truth," and that our conclusions about tree trimming are not drawn from books and the laboratories, but from a long period of intelligent observation in the field. It is natural, too, that if they have brain capacity enough to know the truth in tree trimming that they would try to hide it and encourage the industry which has given them employment for so long. They do not care if they kill a man's trees. They are "out for money," and as long as people will continue to pay for having their trees butchered the butcher will continue to live easy and laugh at the scientist who would interfere with his outrageous work."

All necessary pruning may be done after the season of growth is ended or before it begins. Every wound made in the process of trimming should be protected by an application of thick paint or gas tar to prevent the entrance of rain, the spores of fungi, or attacks of insects, which in some cases are made only in the tree wound. Every branch cut from a tree should be cleanly cut close to the main stem and not leave an unsightly stub to decay, from which, most surely, decay will spread to other portions of the tree.

The arrangement of trees on a street and their proper protection are subjects of prime importance and ought always to be considered when any systematic planting is to be undertaken. The first requisite is, that they be properly spaced so as not to crowd each other when fully developed. They should not be placed opposite on the two sides of a street, but rather alternately, so that a tree on one side will stand opposite the space between two trees on the other side. By this method of planting there is the least amount of crown interference, light is admitted to the street and around the trees, and the circulation of air is less impeded. This method of planting will give uniform distribution of shade, while opposite planting will likely result in places of dense shade followed by spaces where there is none at all. Trees set along the street curb should be protected by guards of ample height. Every municipality with any regard for its trees should have an ordinance forbidding the hitching of horses to trees. Trees planted on the inside of the sidewalk, where it is always best to put them if possible, do not need the same protection as those along the curb; but any street tree in its young and tender stage should be protected by a suitable tree guard.

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Along with protection from violence, generally, should come protection from insects, already mentioned, and this probably may be had only when the street trees are under the care of the general municipal government.

The illustrations presented herewith will argue more forcibly for what is contained in the above than any description possibly can do.

Plate No. XIV, which is reproduced by the courtesy of the Minister of Agriculture, from the Second Report of the Horticultural Societies of Ontario for the year 1907, shows the ideal street planting in a residence neighborhood. The trees are planted on the inside of the sidewalk and have been permitted to retain their full, rounded, natural shape. The tree trimmer has never mutilated these trees. The houses stand well back from the line of the street, the distance from the sidewalk to the front porch being, at least, twenty-five feet. The trees in no way interfere with the buildings, an abundance of light may enter, and the circulation of air is in no wise impeded. There is room for a variety of ornamental lawn planting between the trees and the buildings. The whole aspect of the street is one of beauty and refinement, clearly evincing an intelligent plan throughout the whole.

Plate No. XVI, shows a view in the borough of West Chester, Pa., where the street trees have been allowed to grow to a normal size and form. Here the planting, however, is along the curb line which causes the crowns of the trees on both sides of the street nearly to meet overhead. If the houses were farther removed from the sidewalk, inside planting could have been employed. As it is, here we have an illustration of good curb planting with houses closer to the sidewalk, a result that may be accomplished with care and protection bestowed upon the trees.

Plate No. XV, shows what the itinerant, unskilled tree butcher is capable of doing. It is a view from a street in the city of Harrisburg. These trees are "pruned," and the man who did the work would say that the jub is well done. As to how well it is done the picture itself speaks. These trees are forever ruined. They will no longer be able to assume their natural shape, and the great mass of twigs which will be thrown out about the places of cutting, will crowd the head for a time, and then break away from their hold on the stem by reason of insecure support. In the meantime disease will enter through the large wounds which were not treated, and the early death of the tree is sure to follow. It will also be noted what care was employed to place two especially attractive poles immediately in front of the building.

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PLATE XVII. "The City Browsing Ground."

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FOREST NURSERY PRACTICE AND SYLVICULTURAL NOTES ON THE MORE IMPORTANT PENNSYLVANIA FOREST TREES.

RALPH E. BROCK, Forester.

In these notes little claim of originality is made. They are simply a collection of notes from all sources, together with results obtained from patient observation of trees and practical experience derived in the raising of forest tree seedlings.

The Forest Nursery.

Forest nursery practice consists in the ability to raise the greatest number of seedlings on the smallest area at the least possible expense; but the raising of trees from seed is not the only object in forestry, although the success the forester has in raising the seedlings, together with the lowness in price in producing them, in a great measure determines the success of his operations. The task of raising seedlings is no easy work, for, as said by George H. Wirt, State Forester of Pennsylvania, in his bulletin concerning the propagation of trees of Pennsylvania, "The methods of raising trees are as varied and as numerous as the trees themselves, the people who plant them, and the localities in which they are planted. In other words, the conditions under which each planter has to work are so different that there can be no exact method laid down that will be applicable for all trees and all conditions. But there are certain laws of plant life in general, and facts in regard to different trees, that, being reinforced by observation of nature and by common sense will undoubtedly lead to a measurable degree of success." Nursery men cannot afford to rush blindly into the art of raising trees. The laws that govern the different physical conditions of plant life must be diligently studied, also the soil, its chemical composition, depth, moisture, and porosity. Dr. Fernow says, "Trees, like most plants, originate from seed, build up a body of cell tissues, from foliage, flowers and fruit, and take up food material from the soil and air, which they convert into cellulose and other compounds from which all their parts are formed; they rely like other plants, upon moisture, heat and light as the means of performing the function of growth, yet there are some peculiarities in their behavior, their life and their growth, which require special attention, on the

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part of a tree grower or forest planter." Trees derive their food and solid substance from the air and in part from the soil. The solid part of their bodies is made up of cellulose which consists largely of carbon (44 per cent. of its weight) with hydrogen and oxygen added in almost the same proportions as in water. The carbon is derived from the carbonic acid of the air, which enters into the leaves, and, under the influence of light, air, and water, is decomposed. The oxygen is exhaled. The carbon is retained and combined with elements derived from the water, forming compounds such as starch, sugar, etc., which are used as food materials, passing down the tree through its outer layers to the very tips of the roots, making new wood along the branches, trunk, and roots. This process of food preparation, called assimilation, can be carried on only in green parts, and in these only when exposed to light and air. Hence foliage, air, and light at the tops are essential perquisites for tree growth, and hence, other conditions being favorable, the more foliage, and the better developed it is, and the more light this foliage has at its disposal, the more vigorous will the tree grow. In general, therefore, pruning, since it reduces the amount of foliage, reduces also, for the time, the amount of wood formed, and just so shading, reducing the activity of foliage, reduces the growth of wood.

Soil Conditions.

From the soil trees take mainly water, which enters through the roots and is carried through the younger parts of the tree to the leaves, to be used in part on its passage for food and wood formation, and in part to be given up to the air by transpiration. In the water, mineral substances are taken up only in small quantities, and these are mostly the commoner sorts, such as lime, potash, magnesia, and nitrogen. These are carried in solution to the leaves, where they are used (as perhaps also on their passage through the tree) with a part of the water, in food preparation. The main part of the mineral substances taken up remains, however, as the water transpires, in the leaves and young twigs, and is returned to the soil when the leaves are shed or when the tree is cut and the brush left to decompose and make humus. Hence the improvement of the fertility of the soil by wood crops is explained, the minerals being returned in more soluble form to the soil, as also by the fact that wood crops do not exhaust the soil of its minerals, provided the leaves and litter are allowed to remain on the ground. For this reason there is no necessity of alternating wood crops, as far as their mineral needs are concerned. The same kind of trees can be grown on the same soil continuously, provided the soil is not allowed to deteriorate from other causes. As the foliage can perform its

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work of food assimilation only when sufficient water is at its disposal, the amount of growth is also dependent not only on the presence of sufficient sources of water supply, but also on the opportunity had by the roots to utilize the supply, and this opportunity is dependent upon the condition of the soil. If the soil is compact, so that the rain water cannot penetrate readily, and runs off superficially, or if it is of coarse grain and so deep that the water rapidly sinks out of reach of the roots and cannot be drawn up by capillary action, the water supply is of no avail to the plants; but if the soil is porous and moderately deep (depth being the distance from the surface to the impenetrable subsoil, rock or ground water) the water cannot only penetrate but also can readily be reached and taken up by the roots. The moisture of the soil being the most important element in it for tree growth, the greatest attention must be given to its conservation and most advantageous distribution through the soil. No tree grows to the best advantage in very dry or very wet soil, although some can live and almost thrive in such unfavorable situations. A moderately but evenly moist soil, porous and deep enough or fissured enough to be well drained, and yet of such a structure that the water supplies from the depths can readily be drawn up and become available to the roots, is the soil on which all trees grow most thriftly.

The agriculturist procures this condition of the soil as far as possible by plowing, drainage, and irrigation, and he tries by cultivating to keep the soil from compacting again, as it does under the influence of the beating rain and of the drying of the upper layers by sun and wind.

The forest grower cannot rely upon such methods, because they are either too expensive or entirely impracticable. He may, indeed, plow for his first planting and cultivate the young trees, but in a few years this last operation will become impossible and the effects of the first operation will be lost. He must, therefore, attain his object in another manner, namely, by shading and mulching the soil. The shading is done at first by planting very closely, so that the ground may be protected as soon as possible from the sun and wind, and by maintaining the shade well throughout the period of growth. This shade is maintained, if necessary, by more planting, and in case the main crop in later life thins out inordinately in the crowns or tops, or by the accidental death of trees, it may even become desirable to introduce an underbrush. The mulching is done by allowing the fallen leaves and twigs to remain and decay, and form a cover of rich mold or humus. This protective cover permits the rain and snow waters to penetrate without compacting the soil, keeps it granular and in best condition for conducting water, and,

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at the same time, prevents evaporation at the surface. The soil moisture, therefore, is best maintained by proper soil cover, which is needful only in naturally dry soils. Wet soils, although supporting tree growth, do not, if constantly wet, produce satisfactory wood crops, the growth being slow. Hence they must be drained and their water level sunk below the depth of the root system.

Irrigation is generally too expensive to be applied to wood crops, except perhaps in the arid regions, where the benefit of the shelter belt may warrant the expense.

Attention to favorable moisture conditions in the soil requires the selection of such kinds of trees as shade well for a long time. It is also required to plant closely, to protect the woody undergrowth (but not weeds), and to leave the litter on the ground as a mulch.

Different species adapt themselves to different degrees of soil moisture, and the crop should be selected with reference to its adaptation to available moisture supplies. While, as stated, all trees thrive best with a moderate and even supply of moisture, some, like the conifers, can get along with very little, especially pines; others can exist even with an excessive supply, as the bald cypress, honey locust, some oaks. The climate, however, must also be considered in this connection, for a tree species succeeding well enough on a dry soil in an atmosphere which does not require much transpiration, may not succeed in a drier climate on the same soil. In the selection of different kinds of trees for different soils, the water conditions of the soil should, therefore, determine the choice.

Light Conditions.

To insure the largest amount of growth, full enjoyment of sunlight is needed. But as light is almost always accompanied by heat and relative dryness of air, which demands water from the plant, and may increase transpiration from the leaves inordinately, making them pump too hard, as it were, young seedlings of tree species whose foliage is not built for such strains require partial shading for the first year or two. In later life the light conditions exert a three-fold influence on the development of the tree, namely, with reference to soil conditions, with reference to form development, and with reference to amount of growth.

The art of the forester consists in regulating the light conditions so as to secure the full benefit of the stimulating effect of light on growth, without the deteriorating influences on the soil and on form development. As we have seen, shade is desirable in order to preserve soil moisture. Now, while young trees of all kinds, during the "brush" stage of development, have a rather dense foilage, as they grow older they vary in habit, especially when growing in the for-

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est. Some, like the beech, the sugar maple, the hemlock, and the spruce, keep up a dense crown; others, like the chestnut, the oaks, the walnut, the tulip tree, and the white pine, thin out more and more, and when fully grown have a much less dense foliage; finally there are some which do not keep up a dense shade for any length of time, like the black and honey locust, with their small thin leaves, the catalpa, with its large but few leaves at the end of the branchlets only, and the larch, with its short scattered bunches of needles. So we can establish a comparative scale of trees with reference to the amount of shade which they can give continuously, as densely foliaged and thinly foliaged, in various gradations. If we planted all beech or sugar maple, the desirable shading of the soil would never be lacking, while if we planted all locust or catalpa, the sun would soon reach the soil and dry it out, or permit a growth of grass or weeds, which is worse, because these transpire still larger quantities of water than the bare ground evaporates or any woody undergrowth would transpire. Of course a densely foliaged tree has many more leaves to shed than a thinly foliaged one, and, therefore, makes more litter, which increases the favorable mulch cover of the soil. Another reason for keeping the ground well shaded is that the litter then decomposes slowly, but into a desirable humus, which acts favorably upon the soil, while if the litter is exposed to light, an undesirable, partly decomposed "raw" humus is apt to be formed. Favorable soil conditions, then, require shade, while wood growth is increased by full enjoyment of light. To satisfy both requirements, mixed planting with proper selection of shade-enduring and light-needing species is resorted to. As the different species afford shade in different degrees, so they require for their development different degrees of light. The dense foliage of the beech, with a large number of leaves in the interior of the crown, proves that the leaves can exist and perform their work with a small amount of light. The beech is a shade-enduring tree. The scanty foliage of the birches, poplars, or pines, shows that these are light-needing trees; hence, they are never found under the dense shade of the former, while the shade-enduring can develop satisfactorily under the light shade of the thin foliaged kinds. Very favorable soil conditions increase the shade endurance of the latter, and climatic conditions also modify their position in the scale.

All trees ultimately thrive best, i. e., grow most vigorously, in the full enjoyment of light, but their energy then goes into branching. Crowded together, with the side light cut off, the lower lateral branches soon die and fall, while the main energy of growth is put into the shaft, and height growth is stimulated. The denser shade of the shade-enduring kinds, if placed as neighbors to light-needing

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ones, is most effective in producing this result, provided that the light is not cut off at the top. Thus, in practice, advantage is taken of the relative requirements for light of the various species. The forester finds in close planting and in mixed growth a means of securing tall, clear trunks, free from knots, and he is able, moreover, by proper regulation of light conditions, to influence the form development, and also the quality of his crop, since slow growth and rapid growth produce wood of different character.

There are some species, which, although light foliaged and giving comparatively little shade, are yet shade-enduring, that is, can subsist, although not develop favorably, under shade. The oaks are examples of this kind. Others, like the black cherry, bear a dense crown for the first twenty years, perhaps seemingly indicating great shade endurance, but the fact that they soon clear themselves of branches and finally develop a thin crown, indicates that they are light-needing, though good shaders for the first few years. Others, again, like the catalpa, which is shady and shade-enduring, indicated by the difficulty with which it clears itself, leaf out so late and lose their foliage so early, that their shading value is thereby impaired. Black locust and honey locust, on the other hand, leave no doubt either as to their light-needing or their inferior shading qualities. That soil conditions and climatic conditions also modify crown development and shade endurance is a fact well recognized abroad; but in our country this influence is much more important on account of the great variation in those conditions. Thus, the box elder, an excellent shader in certain portions of the west, is a failure as soil cover in other localities where it nevertheless will grow.

We see, then, that in determining the shading value as well as the shade endurance of one species in comparison with another, with reference to forestry purposes, not only soil and climate, but also the character of the foliage and its length of season must be considered.

Manuring.

In the raising of crops of all descriptions, the most important fact to study is how to preserve the fertility of the soil. This is of prime importance in all stages of forest planting.

In forest nursery practice, many methods are advised, but without doubt, that of the use of vegetable composts is the most useful and inexpensive. This can easily be accomplished by mixing the weeds and scrapings from the walks, etc., in alternate layers and by turning frequently, adding a small quantity of wood ashes and lime each time. A compost of this kind is inexpensive, valuable, and can be used in two years.

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In some cases the land is "petered," that is the sod is peeled off and burned and the ashes spread over the nursery beds. (The ash is better if kept as a compost several years).

It is not advisable, as a rule, to use lime alone on lands for nursery purposes. In the nurseries at Mont Alto, lime has killed Norway spruce and has been found to be a detriment to white pine seedlings, when used in large quantities. An agricultural journal prints that "lime has been found beneficial to the cherry, linden and the elm."

By this, I do not mean to condemn lime as a fertilizer, when used sparingly, as experience has demonstrated its great value as a decomposer in composts; but only to caution against a too liberal use of it.

In the use of all fertilizers it should be remembered that a manure or fertilizer should be one that does not force the plant unduly, but one that is so balanced as to start growth sufficiently, and at the same time not hinder wood formation. Wood ashes have been used with success in the raising of coniferous seedlings.

At the present time there are no complete fertilizers on the market in America that are recommended for nursery work, and in home made fertilizers care should be used in the selection of materials. Only slow-acting fertilizers should be bought. Such ingredients as nitrate of soda, as a rule, leach away before they can be used by the seedlings, and are too vigorous. When bone meal or kainit are used they should be put into the beds several days, or longer, before the seeds are planted. Such fertilizers have a beneficial effect on the soil for upwards of ten years, so it is obvious that fertilizers should be used but seldom, and only when necessity demands their use, for it will be found that the use of natural manures is preferable in the maintaining of soil fertility.

Collection of Seed.

Seed are naturally disseminated by means of wind, water, and animals.

Those disseminated by means of the wind should be gathered from the trees prior to falling. It is therefore important to know when the seed matures. Among American trees, conifers, the pine, larch, spruce, fir, hemlock, produce seed for wind dissemination, and must ordinarily be collected from the trees. The cedar is the only American conifer that is not wind disseminated.

Among broadleafs, special adaptations are formed, as in the willow, poplar, birch, elm, tulip poplar, buttonwood, maple, and ash. Three genera, hornbeam, blue beech, and the linden produce fruit provided with special accessories which buoy the fruit and aid in

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their dissemination. One genus among broadleafs produces seed with wings, the catalpa.

In the above mentioned trees there is a wide variation in development and maturity. In the elm and some maples only from eight to ten weeks are required, whilst in the pines two years are needed. Wind disseminated seed which ripen in late spring or early summer germinate at once. The ones that ripen in the fall may or may not germinate the following spring or for several years. Seed ripening in the spring or early summer must be gathered then and planted. Almost all conifers excepting the cedars and a few others, birch, alder, hornbeam, tulip poplar, some of the maples, ashes, and catalpa, germinate, if planted, in from one to six weeks after warm weather begins. The hard or sugar maple is one of the first to germinate and make rapid growth. It should be planted from about the middle of March along to April, as in the case of the buttonwood, hornbeam, or linden.

With the poplars and willows, the seed are disseminated by the wind. None of the fleshy fruited trees is wind disseminated. In wind disseminated species the seed is collected, as follows:

1. Climbing trees and removing fruit with some special instrument.

2. Shaking down and collecting fruit in blankets, etc., placed beneath the tree.

3. Collected during lumbering operations.

4. Collecting from low crowned isolated trees in the open. (Better seed than thin crowned forest trees.)

Among Pennsylvania trees there is a wide variation of time that the fruit remains on the tree. Among wind disseminated species, poplars, willows, elms, and maples should be collected at maturity. Birch, elm, hornbeam, blue beech, ash, and linden are disseminated during the fall and winter, after the larger portion of the seed falls upon the snow. The fruit of the buttonwood almost always hangs on the tree till the following spring, and then can be collected. This is also true of the catalpa. Among the conifers, most of the seed are scattered after the first fall frost. Pennsylvania trees that bear dry, heavy fruit do not have their seed wind disseminated, but they are scattered by birds and animals. This class of fruit may be picked from the ground after it has fallen from the tree. A good rule is not to be too quick to gather seed of this class, as the first seed to fall is invariably bad. The common representatives of this fruit include the walnut, hickory, beech, and horse-chestnut. The best time to collect all of this class is after a good frost. Nearly all of these fruits are heavy and the good may be separated from the bad by placing in a pail of water. One family, the witch-hazel, is

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closely allied to this group. The fruit is capsular. When dry, the seed is shot out from the capsule by its elastic walls, so this seed, if wanted, must be gathered early. The species, though, is valueless as a forest tree. In the locust, in fact the whole pea family, locust, honey locust, and Kentucky coffee tree, all the pods do not ripen at one time, so if possible, it is better to gather all the pods from the tree, or collect in winter from fence corners. In a few instances, we have trees with seed well adapted for water dissemination, as in the birch. In this tree, always found along water courses, the branches hang low over the water, the fruit is shed early and may be gathered in the eddies. Thus, naturally, birch belongs in the quiet places along streams.

Fleshy Fruits or Fleshy Seed.

Only in comparatively rare cases are fleshy seed found, as in the mountain magnolia and cucumber tree. All the rest have fleshy pericarps and are usually scattered by animals. With few exceptions this class falls from the trees soon after ripening.

In few cases, as the magnolia, the fruit breaks open and frees the seed. In the rest we collect and remove the fleshy parts before planting. In the gymnosperms, e. g., some of the cedars, and in the angiosperms, e. g., the dogwood, leatherwood, and persimmon, have fleshy fruits and cling to the tree till late winter. The fruit hangs on the tree long after maturity. An exception to this is the mulberry, which ripens early and must be collected immediately as should the poplar and sassafras.

With few exceptions dry fruited species suited for wind dissemination should be collected from seed trees. Dry fruited species not suitable for such gathering, also fleshy fruited species should be gathered from the ground. All species where the fruit does not fall informally should be collected from the trees. The trees best suited to select and gather seed from should be,

1st. Vigorous, thrifty trees.

2d. Middle aged trees.

3d. Trees growing in the open.

4th. Trees without serious defect.

The cost of seed fluctuates from year to year, and seed often is unprocurable. The reason of this is the irregularity of trees in producing their crops of seed, limited and uncertain demand, special care necessary in storing seed, etc. The cost is greater in the United States than in Europe, where the market is larger, but in all cases it is necessary to place your order early.

In the selection of seed, buy only from reliable collectors, when the seed cannot be secured by yourself, and then make a test for

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germination. It is useless to plant seed unless you can almost to a certainty tell what you will get from them. Among the reliable collectors and dealers, are:

R. Douglas Sons, Waukegan, Ill.
Elizabeth Nursery Co., Elizabeth, N. J.
Evergreen Nursery, C. L. Whitney, Warren, Ohio.
Evergreen Nursery Co., Sturgeon Bay, Wis.
Harvard Evergreen Nurseries, Robt. C. Uecke, Prop., Harvard, Ill.
Dundee Nurseries, D. Hill, Dundee, Ill.
Evergreen Home Nursery, Mrs. Jea Root, Skaneateles, N. Y.
Thos. Meehan & Sons, Inc., Dreshertown, Pa.
Otto Katzenstein & Co., Atlanta, Ga.
J. M. Thorburn & Co., New York City (36 Cortlandt St.)
C. R. Pettis, Lake Clear Junction, N. Y.

Treatment of Special Seed and Fruits.

Fruits often require special treatment to separate the seed from the rest of the fruit as in the conifers, pines, firs, spruce, and in the broadleafs, walnut, beech, mulberry, and locust. In Germany where many seed are used, much care is given to the removal of the hulls. For conifers, special drying houses are provided, where heat up to 100 degrees F. is provided for drying the fruit. After heating it is placed into hollow cylinders and the seed shaken out. One hundred and fifty degrees F. is fatal to seed. Great care must also be taken with the fleshy fruits, the seed being separated from the pulp by the maceration of the fruit.

Here at Mont Alto, the cones of the conifers are collected when mature and spread in thin layers on wire shelves. They are agitated daily by shaking. The seed falls through the interstices of the wire when liberated and is collected on a cloth shelf below.

The cones of the fir fall apart as soon as they are dried. In all conifers the scales must be cleaned from the seed. This can most easily be done by the use of a winnowing mill, or by taking the seed out in a slight breeze and lifting a handful of seed at a time. The seed, being the heavier, falls back into the receptacle and the light scales blow away.

In the case of the juniper, place for a few days into a pail of water to which a small piece of lye may be added and then put through a colander. This seed does not easily germinate. The fruit when collected may be placed into a hole with a quantity of humus or decaying leaves, allowed to remain for a year or two, then washed. After this they will soon germinate. Another method is recommended: Place the seed in bran and feed to cattle, catch the manure,

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and extract the seed. It is best to hang up the seed of the conifers in a dry loft, but junipers keep best in a rot hole, or when stratified. Walnuts, after hulling, are kept best when stratified, but it is unnecessary to remove the hulls. The method of stratification consists in taking a box of convenient size to handle, placing a layer of sand in the bottom, then a layer of nuts, and so on with alternate layers of sand and nuts until within several inches of the top. Bury the whole in well drained soil, and mark the place for convenience in the spring. In the case of the beech freezing is not an advantage, and it may be placed in a cellar or into a box buried in the side of a hill. It is best though to macerate such fleshy fruits as the osage orange and mulberry, for fungi easily enter fleshy fruits and ruin the seed. Cherries should be bruised and washed from their cover. The locust and all of that family should be hung up in bags, pods and all, until spring, when the seed should be picked from them, or the bags beaten and the seeds sifted from the chaff. Seed should not be stored immediately after gathering but should be laid out to dry. If they should become too dry dampen slightly. Do not hang up until cold weather. A good plan is to follow nature in all ways as far as possible.

In the case of oaks, walnuts, hickories, etc., while they can be safely kept over, it is much more satisfactory to plant at once.

Nature sows most of her seed in the fall, but seed sown at this time suffers greatly from the ravages of small animals. For this reason alone it is safer to keep the seed over winter by artificial methods where there is no likelihood of such depredation. If nature stratifies her seed over winter, we should, and where she keeps them on the tree over winter, we can safely keep in bags suspended. Conifers should be kept dry, oaks and walnuts stratified. The wisdom of this is, if walnuts are stratified they will germinate the following spring, and if kept dry, they will hardly germinate for a year, if even then.

Some seeds, such as the oaks (especially the white oak and the common chestnut), are very hard to keep over winter, unless previously treated. So far, the most successful method found is to take a small cask, as nearly air tight as possible, and put a bushel or more of the seed into it and place on top of the seed a cup or deep saucer nearly full of carbon bisulphide. This exceedingly volatile liquid can be purchased at any drug store for 25 cents per pound. Close the top of the cask and keep it tight for several days. Care should be taken to keep fire away. For this reason perform the operation out of doors or in some out building. Seed thus treated should be stratified or planted at once. This gas is very penetrating

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and kills all insects and injurious larvae, but is harmless to the seed. This same liquid is useful to kill injurious larvae cutworms, etc., that may be in the soil. The usual method being to drill holes four feet apart each way and pour a large spoonful of carbon bisulphide therein and seal the hole with dirt. This treatment is effective. If there are underground passages, ignite gas at entrance of opening with a long taper, close hole and allow the gas to penetrate all passage ways. It is said that this treatment is harmless to plant life if judiciously handled, but is, on the other hand, a plant incentive. I have always used it successfully several weeks before planting.

Fertility of Seed and Age of Trees.

In sowing seed, it is necessary to know the percentage of germination. This is dependent on,

1st. Species. Some species produce more fertile seed than others.

2d. Seasons. Some species vary with the weather conditions.

3d. Locality. Seed germinate best within their natural limits.

4th. Individual Trees. Some trees of the same species yield a higher per cent. of fertile seed than others.

This knowledge of the variability of germination is of value when time is not to be had for testing the seed. Some species, as white pine, produce normally seed of a high per cent. of fertility, often from ninety-five to ninety-seven per cent; whereas, the tulip poplar falls as low as four per cent. or even to zero. It is said that the best seed are obtained from the higher branches.

Determining the Fertility of Tree Seeds.

In planting seed, no matter how collected or from whom bought, they should always be tested by the planter. Much of the inner condition can be determined by a good lens or a pocket knife, whether the seed is full and sound, whether hollow, decayed, wormy and worthless. Plump, firm, and moist seed are usually good. This can all be learned by experience. Seed may be partially dried and still be good. Even when the kernel rattles in the shell the seed may possibly germinate; but the only absolute test for fertility is to germinate some of the average seed.

Most of the conifers and allied species will germinate in from two to six weeks. The tulip poplar may take several months. The simplest test is to count out several hundred seed and put into a pan or box of good sand, subject it to heat from below, and keep moist. For delicate and small seed the moss test should be em-

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ployed. Place a layer of sand in a shallow box, the seed on this, and cover with a layer of slightly wet moss. There should be holes in the bottom of the box for the excessive moisture to escape.

The Germinating Box.

The box is usually of tin, with a net work of wires horizontally placed, to which cloth is fastened by alternating wires. By pushing the wires together the cloth is allowed to be in contact with the water pan in the bottom. The seed is placed in the folds of the cloth. In this box the seed will readily germinate. Seed requiring a longer time to sprout may be placed between moist blotting pads whose ends lie in water, or flannel may be substituted for blotting pads. In seed testing laboratories, a water jacket oven is used. Little dishes containing the seed to be tested are put in and proper moisture condition is kept. Rebelious seed must be actually planted, i. e., seed that require two to three years to sprout. A good nurseryman aims to get fresh seed. He sows early and thickly, on the principle that it is easier to thin out seedlings than to have half a crop. Seed should be thoroughly ripened when collected, because ripe seed have stronger vitality than immature seed.

Vitality.

The natural vitality of forest tree seed decreases with age. Those having the shortest vitality are those with thin protection. Those having firm, strong kernels have greater vitality than those which are soft and oily. For example, the poplars, willows, and maples have a short existence unless preserved artificially. A great deal depends on the way we preserve seed after maturity. Nearly all nuts and acorns, chestnuts, walnuts, and beech, cannot be kept more than a year. Especial care is constantly required in preserving the vitality of seed artificially. The seed that can be kept the longest are those from dry fruited species. Rebellious seed can easily be kept from two to three years or longer, as the cedar and locust.

Table of Germinating Percentages.

Name.	Per Cent. of Germination of Fresh Seed.
White pine,	75-90
Bull pine,	60-85
Scotch pine,	60-80

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Red pine,	65-95
European larch,	55-75
American larch,	70-85
Sprues,	60-75
Hemlock,	30-60
Fir,	30-60
Arbor vitae;	50-75
Cedar,	50-75
White walnut,	45-70
Black walnut,	50-75
Hickories,	50-85
Birch,	65-80
Beech,	75-95
Chestnut,	70-95
Oaks varying with species,	60-95
Elm,	50-80
Mulberry,	75-90
Osage orange,	55-90
Sycamore,	45-60
Cherry,	75-90
Black locust,	70-80
Honey locust,	70-80
Kentucky coffee tree,	70-80
Maples,	35-50
Ash,	25-50
Catalpa,	35-85

As all seed gradually lose vitality, it is expedient always to plant fresh seed.

The Storing of Seed.

Various are the methods of keeping seed over winter. They are kept in both a wet or a dry condition. Dealers stratify the nuts only. Except in the case of oily seed, these are best planted in the fall. Large, well ventilated store houses are provided in which seed may be hung. In experiments conducted at Yale University, coniferous seed that was stratified decayed, that hung up in bags kept well. In stratification it is best for small quantities of seed to use pieces of cloth, and when put into sand no two pieces of cloth should touch. Always in stratification use sand, and always moisten sand where the drainage is perfect. Boxes should be covered with boards so that water cannot enter from the top. It has been recommended to keep boxes always in an unheated cellar or in a sheltered nook not subjected to direct rainfall. In forest work, where large quantities of seed are stored, chestnuts, oaks, etc., are

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spread on the floor until cold weather, then they are mixed with sand, heaped and covered with straw, and later covered with earth, leaving a hole at the top for ventilation. Seed can also be kept in narrow trenches one foot wide and one foot deep, on a sloping hillside. The nuts are mixed with sand and piled in the trench, fill the trench as the weather grows colder, leaving a hole for ventilation. Remove in spring, gradually. The trenches should be dug in well drained soil. In all cases where seed are stratified loose in the ground, and in large quantities, the planter will wish he had used boxes; for it is a provoking task to pick seed out one by one from half frozen or muddy ground. Acorns and chestnuts keep better heaped on the floor as noted above. White ash keeps nicely suspended in a cool, dry place in bags.

Facts Determining Prompt and Slow Germination.

1. Inherent character of the species.
2. Degree of moisture.
3. Degree of warmth.
   (a) Character of the weather usually influences the time when different species germinate.
   (b) The character of the seed coats, as in pine and cedar. Here the seed coats are excessively thick and retard germination.
   (c) The character of the kernel itself as in the locust, or honey locust, where the substance of the kernel is horn like.

Rebellious seed includes all seed that cannot be forced to germinate quickly. Red cedar is the most rebellious of Pennsylvania trees, if not of American trees. As said before, they should be placed in a rot hole for several years. The application of hot water is the only practical way of treating such seed. This is also true of the black and honey locust, and of the Kentucky coffee tree. Boiling water almost invariably kills the seed. The maximum heat to be applied should be about six degrees below boiling point centigrade.

The Choice of Species.

Do not rush on this score. Always observe the species growing in the vicinity of the prospective plantation and the quality of the locality, because it is the choice of the species upon which the success and profit of the plantation will depend. Full success for a species depends greatly on its suitability for the object of planting. The species selected must be capable of furnishing the desired products. Select species having a high annual increment. If the greatest amount of material is desired, the value of the product and the expense incurred must be considered. Only a few species in each

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locality pay well. In all cases there are only a few species that one is justified in planting. For example, in Franklin county (Mont Alto) one would not plant anything except white pine, red oak, or chestnut. After planting, the sylvicultural system under which one is working must always be kept in mind; hence, understand as much as possible the tree from the seed to the final cutting, before planting.

Where the danger from fire is great, plant hardwoods, not conifers, and in regions of great winds do not plant soft maples and poplars. We should plant only such species as tend to preserve and maintain the soil conditions. This is essential to derive good crops. In other words, know the "quality of the locality." To judge the "quality of the locality" is one of the most difficult things to learn in forestry. Great aids in arriving at such knowledge are the climate factors, altitude, aspect, gradient, contour, temperature, moisture, and air currents. In examining the soil and subsoil, the depth, moisture, porosity, quantity and quality of the humus must all be known and worked out for the prospective species. A study of all the tracts to be planted will aid greatly in arriving at a fair conclusion as to the "quality of the locality." Although trees grow naturally in a given plat of ground in a given locality, it is not conclusive that they are fitted best for such conditions; as the red cedar is found growing wild at the northern limits of this State, but it is indigenous to the West Indies. Trees that enrich the soil by supplying rich humus are well to select. Black walnut never grows in pure stands, hence should always be in mixed stands. A given locality is always favorable for several species.

What Trees to Plant.

Adaptability to climate is the first requisite in the species to be planted. It is best to choose from the native trees of the region which is known to be suitable for the species. With regard to species not native, reliance must be placed upon the experience of neighboring planters and upon experiment (at first on a small scale), after study of the requirements of the kinds proposed for trial. Adaptation must be studied, not only with reference to temperature ranges and rainfall, but especially with reference to atmospheric humidity and requirements of transpiration. Many species have a wide range of natural distribution, and hence of climatic adaptation. If such are to be used, it is important to secure seeds from that part of the range of natural distribution where the plants must be hardiest, i. e., the coldest and driest region in which the species occur, which insures hardy qualities in the offspring. For instance, the Douglass spruce from the humid and evenly tempered

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Pacific slope will not be so hardy as that grown from seed collected on the dry and frigid slopes of the Rockies. Lack of attention to this requisite accounts for many failures. It must also be kept in mind that while a species may be able to grow in other than its native climate, its wood may not there have the same valuable qualities which it develops in its native habitat.

Adaptability to soil must be studied less with reference to mineral constituents than to physical condition. Depth and moisture conditions, and the structure of the soil which influence the movement of the water in it, are the most important elements. While all trees thrive best in a moist to "fresh" soil of moderate depth (from two to four feet) and of granular structure, some can adapt themselves to dry or wet, shallow or compact soils. Fissures in rocks into which the roots can penetrate often stand for depth of soil, and usually aid in maintaining favorable moisture conditions. In soils of great depth and of coarse structure, water may drain away so fast as not to be available to the roots. Soil moisture must always be studied in conjunction with atmospheric moisture; for, while a species may thrive in an arid soil when the demands of transpiration are not great, it may not do so when aridity of atmosphere is added. Trees of the swamp are apt to be indifferent to soil moisture and thrive quite as well, if not better, in drier soils.

Adaptability to Site.

While a species may be well adapted to the general climatic conditions of a region, and in general to the soil, there still remains to be considered its adaptability to the particular "site" under which term we may comprise the total effect of general climate, local climate and soil. The general climatic conditions are locally influenced by the slope, exposure or aspect and surroundings. Thus we know that eastern exposures are more liable to frost, western exposures more liable to damage from winds, southern more apt to be hot and to dry out, and northern to be cooler and damper, having in consequence a shorter period of vegetation. Hollows and lowlands are more exposed to frosts and more subject to variations in soil moisture. Hence for these various situations it is advisable to select species which can best withstand such local dangers.

The use, value, or utility of the species is next to be considered. This must be done with reference to the commercial and domestic demands, and the length of time it takes the species to attain its value. The greater variety of purposes a wood may serve, the greater is its general utility. The sooner it attains its use value the better. White pine for the northeastern states is like the apple among fruits, making an all around useful material in large

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quantities per acre in short time. Tulip poplar, applicable to a wider climatic range, is almost as valuable, while oak, ash, and hickory, are standard woods in the market. Other woods are of limited application. Thus the black locust, which grows most quickly into useful posts, has only a limited market, much more limited than it should have. Hickory soon furnishes valuble hoop poles from the thinnings, and later the best wagon material, not however, large quantities in a short time; while black walnut of good quality is very high in price. The market is also limited, and the dark color of the heartwood for which it is prized, is attained only by old trees. The black cherry, used for similar purposes, attains its value much sooner. By planting various species together, a variety of usefulness may be secured and the certainty of a market increased.

The forest value of the specimens is only in part expressed by its use value. As has been shown in another place, the composition of the crop must be such as to insure maintenance of favorable soil conditions, as well as satisfactory development of the crop itself. Some species, although of high use value, like ash and oak, are poor preservers of soil conditions, allowing grass and weeds to enter the plantation and to deteriorate the soil under their thin foliage. Others, like beech, sugar maple, and box elder, although of less use value, being dense foliaged and preserving a shady crown for a long time, are of great forest value as soil improvers. Again, as the value of logs depends largely on their freedom from knots, straightness, and length, it is of importance to secure these qualities. Some valuable species, if grown by themselves, make crooked trunks, do not clear their shafts of branches, and are apt to spread rather than lengthen. If planted in close companionship with others they are forced by these "nurses or forwarders" to make better growths and clean their shafts of branches. Furthermore, from financial considerations, it is well to know that some species develop more rapidly and produce larger quantities of useful material per acre than others. Thus the white pine is a "big cropper," and, combining with this a tolerably good shading quality and being capable of easy reproduction, it is of highest forest value. As the object of forestry is to make money from continued wood crops, use value and forest value must both be considered in the selection of materials for forest planting. Mutual relationship of different species with reference to their relative height growth and relative light requirements, must be considered in starting a mixed plantation.

Mixed forest plantations (made of several kinds) have so many advantages over pure plantations (made of one kind) that they should be preferred, except for very particular reasons. Mixed plantations are capable of producing larger quantities of better and more varied

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material, preserve soil conditions better, are less liable to damage from winds, fires, and insects, and can be more readily reproduced.

The following general rules should guide in making up the composition of a mixed plantation:

(a) Shade. Enduring kinds should form the bulk (five-eighths to seven-eighths) of the plantation, except on specially favored soils where no deterioration is to be feared from planting only light-needing kinds, and in which case these may even be planted by themselves.

(b) The light-needing trees should be surrounded by shade-enduring ones of slower growth, so that the former may not be overtopped, but have the necessary light and be forced by side shade to straight growth.

(c) Shade-enduring species may be grown in admixture with each other when their rate of height growth is about equal, or when the slower growing kind can be protected against the quicker growing. For instance, plant a larger proportion of the former in groups, or cut back the latter.

(d) The more valuable timber trees which are to form the main crop should be disposed individually and planted in such numbers among the secondary crop, or nurse crop, that the latter can be thinned out first without disturbing the former.

Where a plantation of light foliaged trees has been made, black walnut for instance, it can be greatly improved by underplanting densely with a shade-enduring kind; this will choke out weed growth, improve the soil, and, thereby, advance the growth of the plantation. The selection and proper combination of species with reference to this mutual relationship to each other and to the soil are most important elements of success. Availability of the species also still needs consideration in this country, for, although, a species may be very well adapted to the purpose in hand, it may be too difficult to obtain material for planting in the quantity needed or at a reasonable price. While the beech is one of the best species for shade endurance, and hence for soil cover, seedlings cannot be had as yet in quantity. Western conifers, although promising good material for forest planting, are at present too high priced for general use. Some eastern trees can be secured readily, either their seed or seedlings, from the native woods; others must be grown in nurseries before they can be placed into the field. Where to procure seeds or plants, and if the latter, what kind, depends upon a number of considerations. The main crop, that which is to furnish the better timber, had best be planted with nursery grown plants, if of slow growing kinds, perhaps once transplanted with well developed root systems, and in no case to be more than two or three years old. The secondary or nurse crop may then be sown or planted

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with younger and less costly material taken from the woods or grown in seed beds, or else cuttings may be used. In some localities, as on the western plains, the germinating of seeds in the open field is so uncertain and the life of the young seedlings for the first year or two so precarious, that the use of seeds in the field cannot be recommended. In such locations careful selections and treatment of the planting material according to the hardships which it must encounter can alone insure success. Seedlings from six to twelve inches high furnish the best material. The planting of large sized trees is not excluded, but is expensive, and hence often impracticable, besides being less sure of success, since the larger sized tree is apt to lose a greater proportion of its roots in transplanting.

Forest crops can be raised from seed, cuttings, stumps or roots, layers, suckers or coppice. Natural regeneration is always to be striven for rather than artificial regeneration, though these two systems can be combined.

Artificial regeneration is to be accomplished by

1st. Sowing seed in seed beds.

2d. Planting seedlings.

3d. Sowing seed on the spot.

The conditions for success depend much on the species. Species with delicate seed that grow slovenly and slowly are not suited for direct planting; that is, seed of the white pine are not so suitable for direct planting as those of the walnut. The quantity of seed per acre for direct sowing must be computed to a nicety, as the seed must be sown exactly right, neither too thick nor too thin. Enough only is needed to cause the canopy to close in from five to ten years. The amount of seed to be used depends on,

1st. Quality of the seed.

2d. Nature of the soil and soil covering.

3d. Dangers for the seed to overcome.

The following table is taken from Schlich and the German tables:

Species.	Pounds per acre.	Cost of seed per acre.	Cost per acre.
Oak,	550	$0 10	$55 00
Beech,	150	50	75 00
Ash,	35	30	10 50
Maple,	30	75	22 50
Elm,	25	1 00	25 00
European Larch,	14	12 00	168 00
Spruce,	10	2 00	20 00
Pine,	6	3 75	22 50

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Broadcast Sowing.

Broadcast sowing can best be accomplished in the nursery beds. Its success is dependent upon,

1st. Character of the germinating bed.
2d. Manner of covering the seed.
3d. Season of sowing the seed.
4th. Cost of the seed.

The Protection of the Seed in the Germinating Bed, from Birds, Etc.

This may be accomplished by slightly moistening the seed and then stirring in just sufficient red lead to color the seed. Another way is to cover the beds with brush or litter until germination starts, but this and kindred methods are impracticable for large areas, and the red lead method is heartily recommended from experience as the more useful and easier way to treat seed for this purpose. In the work at Mont Alto the treatment of seed by soaking in a solution of blue stone was unsuccessful.

The Germinating Bed.

The ground must have had previous cultivation, and in some special cases the top layer must have been removed where the nursery is to be laid out on recently cleared lands. The top layer, that is stumps, litter, etc., should be burned. The land should be thoroughly plowed and harrowed the fall previous to planting, stone removed, if any, and the beds thrown up roughly for easier handling in the spring. It is a fact that ground left to fallow over winter receives many benefits from the action of frost, snow, and winter rains.

Nursery Work.

In this note general directions for all trees are given. More specific notes are to be found later. The ideal seed beds slope toward the northeast and are fully protected on the south by hedge and wind breaks. The soil is or should be of a sandy loam and retentive of moisture. Protection is afforded by means of screens. Screens can be made by using a frame work 4x10 feet, covered with cheese cloth for individual work; but for permanent work lath screens are generally used. This is done by making a frame work and covering with lath, nailing the alternate lath. Screens of this kind afford one-half shade, which is sufficient for trees. If the lath are stood on edge with same distance between the lath as the width of the lath, one quarter shade would be given. As before stated, light is an essential factor in the raising of seedlings, especially for coniferous seed. The light allowed should be the same as found nat-

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urally surrounding such species. For example, the spruces admit of more shade than the pines. Screens again protect the tender seedlings from the direct force of the beating rains.

In the raising of seedlings for forestry purposes, the chief idea to hold in mind is to get the greatest number of seedlings on the smallest area and have them planted permanently as soon as may be done, using the smallest plants possible, as cheapness is essential. There are two sources of cost in planting, the cost of the stock, and the cost of planting. Both are governed by the size of the seedlings, the cost increasing with the age of the plant, the number of times transplanted, and the labor involved.

Conditions Involved in the Location of Nurseries. Kinds of Plants To Be Grown.

Soil for general nursery purposes (light sandy loam, never heavy clays or muck), should be as in old gardens, and located conveniently to places of planting. The aspect and slope of the land should be gentle to help drainage, and both are governed by the kind of species to be grown. The north slope is good for conifers. On the south slope conifers are apt to start too soon and the soil dry out too quickly. Where possible, all nurseries should be laid out in the form of a rectangle. The area should be sufficient only for the seedlings to be raised.

At the end of the second year when the seedlings are "lifted" or taken out of the beds for transplanting, an area 16 times as large as the seed bed (if fully stocked) will be required, if the transplant rows are placed 8 inches apart and the seedlings 2 inches apart in the row.

Broadleaf seedlings require a larger area on account of their size and more rapid growth. The size will depend on their age, whether one or two years. In German nurseries, oaks are twice pricked.

Time of Sowing Seed.

It is better to keep all conifers until spring and plant broadleafs where practicable in the fall. Sow conifers broadcast, broadleafs in drills. The seed of all coniferous trees are small and a small area will hold a larger number of seedlings than the same area in broadleafs. Conifers must be shaded, either with one-half or one-fourth shade. Seed should be sown in April.

Seed Beds.

Excessive moisture during germination is to be avoided during this season. Allow full light and no shade on all conifers and such

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broadleafs as beech. A fungus growth is created at this time in the presence of excessive moisture that causes root rot and damping off. Root rot attacks even two year old plants. Damping off is to be feared only until the first true leaves are formed. Root rot occurs as a rule beneath the surface and no cause for the death of the seedlings is apparent. The principal agency is "Rhizopotomia" developed by lack of aeration and the presence of excessive moisture. Damping off fungi attacks plants at the surface of the ground. The root system of the disease ridden plant may be uninjured. This disease is prevalent among conifers. No doubt a fungicide, as Bordeaux mixture considerably weakened, would be of advantage at this time. This would consist of two pounds of blue stone or copper sulphate and three pounds of slacked lime in fifty gallons of water. It is a cheap reliable mixture for fungoid diseases, but has never to my knowledge been used in forest nurseries. The active cause of this disease in Phyopthora omnivora. To a limited extent this disease can be lessened by the proper manipulation of the screens. Shade at all times, but it must not be too dense, and in cloudy weather or in case of light rain the screens should be removed. In case of excessive moisture, remove screens one night, and allow beds to dry off frequently. The sprinkling of dry sand over the beds will dry them off. Damping off is never experienced in well drained soils. The proportion of root to stem as well as the size of the plant is controlled by the soil and density of planting. Heavy soil produces small and ill formed root system. For this reason alone one can well afford to look at the roots rather than the stem in purchasing nursery stock. In the case of both conifers and broadleafs close planting is recommended on account of economy.

The Covering of the Seed in Seed Beds.

The covering of the seed prevents injury caused by the sudden changing of weather conditions and prevents ravages that may be caused by birds and small animals.

German Tables for Covering Seed.

Oaks, 1½ inches.
Beech, ¾ inch.
Elms, ⅛ inch.
Pines and Spruces, .6 inch.
Larch, ⅛ inch.

This table is the result of years of practice by leading German nurserymen, but seed will germinate when covered twice this depth.

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They will even sprout on the surface of the ground if the moisture conditions are favorable.

The Watering of the Nursery.

During the entire season watering should be done. Pipes should be laid to and within the nursery, and spigots placed at convenient places to facilitate watering. Sufficient water should be sprinkled on the beds to sink to the walks. This should be done either in the morning before the sun rises to full height or late in the afternoon, the screens manipulated accordingly.

Fall Treatment of Seed Beds.

In this State all beds should be covered or mulched during the cold weather, to protect the seedlings from the heaving action of frost, in the same manner as done by nature in the treatment of her seedlings. Straw or dead leaves make satisfactory mulches. I have found though that pine needles are preferable for several reasons. On conifers as well as broadleafs it is best to put a layer of broadleaves first, then pine needles. The beds are easier to clean in the spring, as the leaves cling together. When the early frosts are over remove the mulch.

PLANTING.

General Directions for Small Groves and Forest Work.

Seedlings vs. Transplants.

Seedlings are plants set out in permanent plantations directly from the seed beds. Transplants are those that have been taken from the seed beds and planted in other beds for one or more years before permanently planted out. Our nurserymen as a rule divide their stock as to size rather than as to whether once or twice transplanted, or seedlings. Seedlings left in the seed beds too long, especially broadleafs, are apt to become spindly and weak. In order to lessen the cost of plants, beds should be so formed that a full stand is secured at the end of the first season, when it is best to prick out one-half and either throw them away or transplant, in

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which latter case the work of pricking out can be done the following spring. Pricking out can be done with white pine at fifty cents per thousand. Transplants are spoken of as, once, twice, or thrice transplanted, and a record of transplanting should be kept in all nurseries as to whether they are one year old transplants from two year old seedlings or otherwise.

Amount of Area for Transplants From a Given Area of Seed Beds.

The method used in this case is that the crowded seedlings must be pricked out in the first year and transplanted in rows six inches apart, three inches apart in the row, allowing each plant eighteen square inches. If the seed beds are fully stored, one plant per square inch of bed surface, it would take eighteen times this amount of space of nursery for transplant beds. If the seed bed space is large enough allow the plants to remain two years, then if they are not pricked out until the second year, one-half or one-third more space will be required per plant, or even fifty square inches. Norway spruce on account of its straight growth requires only one-fourth the space of white pine. Wild seedlings pulled or lifted in late fall or in early spring before the growth has started may be advantageously used, if their roots are pruned and have been transplanted in nursery rows for a year or more.

Factors Influencing Planting.

In the discussion of this subject the following factors must be studied and followed, namely:

Conditions of the weather.
Characteristics of the species to be planted.
Quality of the locality.
Season contemplated in which to do the planting.
Age and size of the plants.
Quality of the plants.
Distribution of the plants on area (density).
Suitable mixture of species.

The conditions of the weather cannot be changed. Success to a great degree depends on this at the time of planting and immediately after, loss being due to lack of sufficient rainfall.

The species that usually has a long root system in proportion to the top and is of rapid growth is easier to plant and handle afterwards than species of slower growth. Species having a much branched root system are quite easy to plant and the loss from breaking the roots is at a minimum. Species such as the oaks and walnuts are difficult to transplant. The same is true of coniferous seedlings, the white pine being easier to plant than the bull pine.

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The quality of the locality must be judged to a certainty in order to insure success. If the quality is good, we can plant without previous preparation of the soil. If the quality be poor, we must improve the soil and the condition of it.

Under the best conditions transplanting is a shock to the plant, but by special care in setting out plants this injury may be considerably reduced. To do this we must plant under the most favorable conditions, and leave all possible soil about the roots. If balls of earth are left on the roots, no care need be paid to the season if the transplanting operation is performed quickly. But this method (planting with balls) is not practicable for forest planting, as it is too expensive even to be considered. In all planting operations, plant the broadleafs first. Conifers are less indifferent to shock than broadleafs, as vegetation starts later in them.

From an economical point of view much depends on the age and size of the plant. Large and thrifty plants are the best to plant, but their cost is against their use. Size is not dependent on age and much difference of size in relation to age is commonly apparent. When spots are filled in a plantation, always fill with regard to size rather than age.

Much more depends on the quality of the plants than either their age or size, because on this factor depends the future condition and value of the forest. Two sub-factors to this are

1st. The condition of the plant when removed from the nursery must not be dwarfed, or lanky, nor must it have been left in the nursery too long.

2d. Great care must be exercised in the removing of all stock from the nursery no matter for what purpose. For practical use a fork spade is the most convenient instrument. In the transportation of stock from nursery to planting area always protect the roots well, no matter what the distance.

Pruning the roots of broadleaf species is always necessary but with conifers it is best to grow and transplant so that this is unnecessary. Pruning is often necessary with large plants on account of the relation of tops to roots, as these should be well balanced. Some species can stand pruning better than others. Conifers stand it poorly. Larch stands it fairly well. Willow, cottonwood, elm, locust, and oak, practically without injury. Beech, hickory, and birch are often injured, but unfavorable soil and climatic conditions will sometimes demand heavy pruning. In the pruning of old stock always cut slantingly and flush with the main stem both for health and looks. A full account of pruning is found in Davy's "Tree Doctor."

For suggestions in planting ornamental trees and small groves, I add a number of notes from such reliable nurserymen as W. H. Moon

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Company, Morrisville, Pa., Hoopes Bro. & Thomas, West Chester, Pa., and Cottage Garden Nursery Company, of Long Island, New York.

Suggestions for Planting.

An old nurseryman once declared that as many as one-half of the trees and shrubs shipped out of the nurseries of the United States died within two years after planting. While there are no statistics either to prove or disprove this assertion, it is a fact that a large proportion of such stock dies within a limited time. This should not occur, and will not happen if the stock is properly selected at the time of planting in the nursery rows, given the proper space in which to develop a healthy root system, balanced by a shapely top, and in addition carefully transplanted, and afforded large space as soon as it commences to crowd. Again, if this care in nursery culture be supplemented by proper attention in digging and packing the stock so as to avoid injuring the roots, followed by right treatment when received by the purchaser, and rightfully and carefully planted in soil fitted for plant growth, only a very small percentage need be lost. The selection, culture, transplanting, packing, and shipping of stock, are under the control of the nurseryman and will be efficiently attended to; but after leaving the nursery, success in growing the plant lies entirely in the hands of the purchaser, who will succeed or fail in proportion to the intelligent care he may bestow upon his stock. With these facts in view the following suggestions as to receiving, unpacking, and planting nursery stock are offered.

Receiving.

When shipments arrive, open the cases or bales promptly, and if the stock cannot be planted at once it should be promptly heeled in, as it must not be allowed to lie around in drying winds or sun with the roots exposed.

Heeling in.

Dig a trench eighteen inches deep for small trees, and two to two and one-half feet deep for large stock, and wide enough to hold all of the roots without bending or breaking. Stand the trees upright, close together in this trench, covering the roots thoroughly with fine soil to the depth of six inches or a foot, ridging up the soil along the line of the trees so that it will shed water during heavy rains. Leave no roots exposed, cover all, and be sure the soil is of sufficient depth and well enough firmed around the roots to prevent the trees blowing over in hard winds. If, upon unpacking, the roots of any tree or shrub are found to be very dry they should be soaked in water or thoroughly wet down before heeling in or planting.

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Unpacking Evergreens.

As soon as unpacked, examine the roots, and if there be any tendency toward dryness plunge the balls into a tub of water and allow them to soak until saturated, then remove and stand in a protected situation, allowing the surplus water to drain off. More care is required in keeping moist the roots of evergreens than any other class of trees, owing to the fact that the sap is resinous, and if once dried cannot be restored to its normal condition, no matter how much water may be supplied.

Planting.

Preparing the Holes.

Dig the hole not less than one foot wider than the root area of the specimen it is to hold, and from a foot to two feet in depth, according to the depth of the root system. If the soil is poor, some rich compost of old rotten manure, leaf mold, sods from an old pasture, or vegetable trash should be thrown into the bottom of the hole and dug into a depth of six inches or more. If the soil at the bottom is a stiff hard clay or a rocky or gravelly hard pan, it should be picked and broken up to the depth of a foot or so, and a goodly proportion of the sods, manure, or trash thoroughly incorporated with it.

Kinds of Soil.

Most horticultural writers lay much strees upon the particular kind of soil one should use in planting trees, shrubs, etc., but the fact is, the planter must use such soil as may be within his reach and supply its deficiencies by the addition of such suitable fertilizing material as may be at his command. How often do we read that the best soil to use is the sod stripped from the rich top of an old meadow, but not every planter has access to convenient and ample supplies of rich old meadows. Therefore, the rule should be, get the rich old meadow soil if it be practicable, but if that be not available don't give up the idea of planting fine trees or shrubs, because you can grow them handsomely and to perfection even if the meadow soil is lacking. Cow and horse manure composted with a liberal allowance of forest leaves, corn stalks, weeds, or any course vegetable trash, turned over once or twice during the six months necessary to decompose it, and furnish with a liberal allowance of rather coarse ground bone at the first turning will supply the plant food required by almost any species of plant if used in the following manner: Mix one-fifth in bulk of the compost with four-fifths in bulk of the soil dug from the hole, choosing preferably there-

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from the top twelve inches of soil and discarding the lower sub-soil, and incorporate this thoroughly by turning. It is always best to prepare a liberal compost heap some time in advance of the period when it might be needed. Such a pile of composted soil is just so much available horticultural capital, and may, like the carefully prepared manure heaps of the farmers in the Black Forest of Bavaria be regarded evidence of the owner's horticultural prosperity.

How to Plant.

Setting the Tree.

To prepare the tree for setting go over the root system carefully and cut off all broken or bruised portions of roots with a clean sharp knife or sharp pruning shears. In setting the tree spread the roots out naturally so that they may not be twisted or crowded but occupy as nearly as possible the same relative position to the trunk that they held previous to being dug. Then fill in gradually with fine soil, working it carefully under and around the roots so that no holes or unfilled spaces will be left. Shake the entire tree up and down with a short rapid movement so as to assist in packing the soil firmly about the roots. Fill in the soil, layer by layer, carefully trampling it down until it is firmly packed about the roots. Continue this process until the hole is filled within about two inches of the top, when the remainder of the soil should be spread in the hole and leveled up and brought to the surface of grade without trampling. In some instances, in very dry weather, a liberal allowance of water may be turned into the hole prior to filling in the last two inches of soil, and allowed to soak away gradually, after which the top soil may be put on and leveled up as above described. Care must be taken not to plant certain classes of trees too deep. The soil mark on the bark of the tree will show the depth at which it stood in the nursery rows, and it should be set as near this depth as possible, no higher, but certainly not more than two or three inches deeper.

Treatment After Planting.

Mulching.

After the hole is filled and the ground brought to grade, the roots should be protected by spreading over the surface a mulch of four to five inches of coarse manure which should extend a little beyond the line of the hole. The importance of such mulching, especially in very dry seasons, should not be overlooked, its object being to hold moisture about the roots and thus aid in the successful growth of the tree after planting. It should always be remem-

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bered that in transplanting a tree a considerable portion of the root system is cut off and lost, regardless of how carefully or skillfully the work may be done, and before the tree can start to grow it must first form new roots in order to get a hold upon the soil. During the semi-dormant period the sun and wind are constantly evaporating the moisture from the trunk, branches, and foliage, and this must be accounted for by preserving constantly a moderate artificial supply of moisture at the roots. Should extreme dry spells, or hot dry weather follow planting, the soil about the base of the tree for a considerably wider space than is occupied by the roots should be occasionally well watered, and in the case of evergreens a liberal spraying of the foliage, two or three times a week, will contribute largely to successful results.

Pruning.

The root systems of all trees are more or less affected, destroyed, and reduced by transplanting, and in order to preserve a proper balance between the top and root system and to provide against excessive evaporation, some portion of the top should be cut back. The nature of such pruning will depend upon the extent of the fibrous root system preserved by the tree. Some hardwood varieties require quite severe pruning, and many of the softwooded sorts need very little. In pruning, always use a sharp knife, making the cut perfectly clean and taking off the branches close to strong buds. Stumps should not be left, as they die back, creating decay and early defects in the tree as it matures. The pruning of a tree is best done as it is set out, and all pruning should be done with a view of preserving the natural form of the tree, and in no case should the tree be cut back into old wood that does not show strong vigorous buds. Some people practice a method of pruning that renders their subjects unnatural and causes them to lose the elegance of appearance presented by well formed, naturally grown trees. It should be remembered that every tree, shrub, or plant has its own peculiar habit of growth, and this very fact contributes largely to its specific beauty. Therefore, in pruning trees, if we seek to train them all into one uniformly regular shape, we will to a large extent destroy their distinctive individualities and produce a sameness that will become tiresome. Pruning should be done with judgment and care, with a view of assisting nature, taking off old or straggling, unsightly branches, and thinning the top of the tree when it has become too dense. All dead wood should always be removed.

Pruning Evergreens.

Except where very formal specimens, such as cones, pyramids, and other set shapes are desired for formal gardening, evergreens should

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not be sheared, but the rampant growths may be annually shortened back with a knife in order to thicken the growth and preserve their shape. This is best done in April or May, just before the trees start in to grow.

The Soil.

Another nurseryman says, the soil intended for a lawn should be plowed the previous season, and before planting should be stirred as deeply as possible having given it a good coat of well decayed manure or well pulverized compost. Should the soil be retentive of moisture, underdraining must be attended to, as it is impossible to grow trees with stagnant water about the roots.

Planting.

Downing very justly said, "Many persons plant a tree as they would a post," and one-half of the failures are in consequence of negligence in this respect. The holes should be dug broader than the roots extend, but not much deeper. With an attendant to hold the tree, begin filling in the best and finest pulverized soil around the roots, taking care that every rootlet be placed in its proper position and in contact with the soil. By all means guard against the roots being matted together. When the hole is partly filled, a bucket of water may be poured in to settle the soil and fill the interstices among the fibers. The hole may now be filled and trodden firmly. Indeed, this firming process is of the greatest importance. Never plant a tree deeper than it stood in the nursery, excepting dwarf pear trees. The junction of the graft and root must, in them, be directly under the ground. We have seen a very beneficial effect produced on newly planted trees, particularly during a drought, by dipping the roots before planting in a thin puddle of mud. This adhering to the small fibers, tends to keep them moist for a long time. After planting, the soil around the tree should be mulched with manure, or coarse litter of any kind to prevent the action of the frost during the winter, and the soil from becoming dry during the summer. Also be careful to stake the tree firmly, protecting the bark by a piece of matting, in case strings are used in tying.

Pruning.

We have frequently advised purchasers how to prune their trees before planting, but the great majority appear to think it spoils the looks of the tree, and consequently, they are never able to form a finely shaped tree.

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Suggestions to Planters.

Another nurseryman says, all bruised or broken branches and roots should be cut off, exposing a smooth surface that will soon heal over. All holes should be dug large enough to admit the roots without cramping. When the plant is set, press pulverized earth firmly about the roots. Use water and fertilizer in moderation.

Treatment of Stock for Transportation.

Cheapness and safety of seedlings are the only thing here considered. Small stock should always be tied in bundles of fifty or one hundred each, and in all cases should be well puddled before packed for shipment. Puddling (which consists in dipping the roots into a bucket of water in which loam has been added until it becomes of the consistency of paste) form a film of moist earth about the roots which prevents evaporation. A good deal depends upon the puddle. The best puddle is loamy clay. After puddling, either heel in the plants or box for shipment. In "heeling in" plants, dig a trench with one side vertical, place the bundles upright in this trench, clean to the collar or the same height where the seedling stood in the nursery bed and place the dirt around the roots by hand and firm. The smallest stock being placed at right angles to the large stock. In heeling in, select a spot in a cool shady place which is not wet, about 70 degrees F. in temperature. This is only a transitory operation, and usually stock should not be so handled more than a month at most.

Density of Planting.

The density of planting should be calculated so as to establish a close cover in from five to ten years. Then a good deal will depend on the temperature, and the quality of the location. On good soil the trees should be wider apart than on poor soil. With hardy species, a strong growth can be established. The object of the planting has very much to do with the spacing of the trees; that is, trees planted for poles and general purposes should be closer together than those merely for decorative purposes.

The canopy depends on the vigor of the tree, rather than the number of plants per acre. The arrangement of the plants should be simple. Although when plants are arranged in triangles, etc., more plants can be used per unit of space, but this is practical only on soil free from rocks, stumps, etc., or land not as a rule forested. When mixed planting is done it is more easily done in regular planting.

The density of the trees is a matter in which most planters fail. The advantage of close planting is in the quicker shading of the soil,

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hence the better preservation of moisture, an improved growth, and form development of the crop. This advantage must be balanced against the increased cost of close planting. The closer the planting the sooner will the plantation be self-sustaining and the surer the success. If planted in squares, or better still in quincunx order (the trees in every other row alternating at equal distances) which is most desirable on account of the more systematic work possible and the more complete cover which it makes, the distance should not be more than four feet, unless for special reasons and conditions, while two feet apart is not too close, and still closer planting is done by nature with the best success. The following numbers of trees per acre are required when planting at distances, as indicated:

Number of Trees per Acre at Different Distances.

1½ feet apart each way,	19,360
1½ feet by 2 feet,	14,520
2 feet apart each way,	10,890
2 feet by 3 feet,	7,260
2 feet by 4 feet,	5,445
3 feet apart each way,	4,840
3 feet by 4 feet,	3,630
4 feet apart each way,	2,722
5 feet apart each way,	1,742
6 feet apart each way,	1,210
8 feet apart each way,	680
10 feet apart each way,	435
12 feet apart each way,	302
15 feet apart each way,	200
18 feet apart each way,	135
20 feet apart each way,	110
22 feet apart each way,	90
25 feet apart each way,	70
30 feet apart each way,	50

Rows 6 feet apart and trees 1 foot apart in the row, 7,260 trees.
Rows 8 feet apart and trees 1 foot apart in the row, 5,445 trees.
Rows 10 feet apart and trees 1 foot apart in the row, 4,356 trees.

To decrease expense the bulk of the plantation may be made of the cheapest kinds of trees that may serve as soil cover and secondary or nurse crop, the main crop of from 300 to 600 trees to consist of better kinds, and of better planting material, mainly of light-needing species. These should be evenly disposed through the plantation, each closely surrounded by the nurse crop. It is, of course understood that not all trees grow up. A constant change in num-

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bers by the death or timely removal of the overshaded takes place, so that the final crop shows at one hundred years a close cover, with hardly 300 trees to the acre.

Proper Mixture of Species.

In planting, separate trees into crop, nurse trees, and fillers. The nurse trees assist in the growth of another tree, especially in the care of young trees. The nurse may be artificial or natural. Fillers are trees planted with the crop trees, because of cheapness and easiness of handling, the expectation being that they will disappear in the thinning as the crop tree approaches maturity. The crop tree is the tree that matures, or the one that was primarily planted for the desired purpose. It is of vital importance to know that an intolerant species will not form a forest, as the ash, walnut, cottonwood, catalpa, basswood, locust, honey locust, or the tulip poplar. Pure planted light demanding trees, if planted in non-forested regions, will grow fairly well for the first twenty years, but fall back and do their worst when they should do their best. This is well illustrated in the catalpa. If the locality is exceptionally good, even trees of the above class (light demanders) will do well in pure stands, as the black walnut along river bottoms, in Kansas, but the case has never been fully demonstrated in this State, to my knowledge.

The larch, an intolerant tree, will not make a good growth unless underplanted. In all cases intolerant species are planted pure. A light thinning should be started early and when ready for underplanting a heavier thinning should be made. In planting a given mixture of species we have no guarantee of the future plantations, unless we know the sylvicultural characteristics of the tree. This is apparent in the early life of the plantation, some species making a rapid growth and choking up more desirable species, as the Russian mulberry in early plantings in the middle west, reported by Mr. Kieffer.

In all plantings, while mixtures are desirable, it is wise to use few species. By frequent thinnings, judiciously handled at the right time, the crop trees can be matured; but where plantings are to be made and nothing further done that is not to be carefully matched, the plantings should be of pure stands. It is essential that the species should show an almost equal growth through life. If not, the more rapid growers, probably the fillers, are going to outstrip all competitors for light, and thus overtop the forest.

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TABULATED STATEMENT OF TIMBER CUT IN PENNSYLVANIA IN 1906.

Counties.	Number of acres cut over.	Number of acres cut over to be used for farming purposes.	Number of feet (board measure) white pine cut.	Number of feet (board measure) hemlock cut.	Number of feet (board measure) other woods cut.	Number of cords of bark peeled.	Number of cords of pulp wood cut.	Number of cords used in the manufacture of alcohol or acid.	Total number of cords of cord wood cut.	Number of feet (board measure) cut for mine props.	Number of feet (board measure) cut for railroad ties.	Number of feet (board measure) cut for telegraph poles.
Adams,	590	109	165,000	55,000	2,108,800	555	.....	75	2,925	.....	.....	.....
Allegheny,	236	212	.....	.....	1,267,000	.....	.....	.....	500	54,600	.....	.....
Armstrong,	600	55	.....	38,000	2,484,771	.....	.....	.....	.....	10,920	.....	.....
Beaver,	185	70	10,000	25,000	989,000	.....	.....	.....	.....	360,360	.....	.....
Bedford,	7,515	1,433	2,552,000	17,504,000	23,524,568	11,510	2,437	2,214	7,891	3,461,580	88,000	2,500
Berks,	478	24	248,500	31,700	1,586,665	248	.....	.....	3,553	103,742	.....	.....
Blair,	2,631	147	364,000	511,575	1,413,000	392	8,267	2,467	11,414	655,200	410,600	.....
Bradford,	5,104	23	4,673,335	31,641,389	15,007,346	19,363	.....	.....	22,240	333,060	.....	.....
Bucks,	111	13	.....	.....	743,198	102	.....	.....	1,800	.....	.....	.....
Butler,	520	135	.....	.....	1,611,150	.....	.....	.....	.....	.....	.....	.....
Cambria,	2,543	114	1,680,000	6,299,000	4,705,000	2,871	606	98	761	1,063,394	100,000	.....
Cameron,	3,662	.....	480,053	61,342,259	18,488,066	29,581	5,350	.....	5,350	.....	.....	.....
Carbon,	334	25	477,000	160,000	534,486	.....	.....	.....	154	908,640	.....	.....
Centre,	4,565	423	4,989,973	2,367,773	9,825,038	1,729	1,100	10,353	13,422	4,848,840	406,600	235,000
Chester,	496	10	.....	20,000	1,716,000	.....	1,491	.....	8,067	.....	.....	1,150,000
Clarion,	226	37	344,000	68,000	1,085,930	30	.....	.....	.....	.....	.....	.....
Clearfield,	9,299	1,994	9,211,000	17,241,000	13,750,000	7,582	.....	84	84	104,600	.....	.....
Clinton,	8,407	25	2,913,510	17,152,823	6,354,718	1,506	6,782	.....	6,882	7,441,440	100,856	.....
Columbia,	516	15	25,000	155,000	750,000	170	.....	.....	59	39,750	330,000	.....
Crawford,	568	51	300,275	812,000	1,639,277	408	.....	.....	961	.....	.....	.....
Cumberland,	367	2	5,000	.....	660,500	274	.....	.....	1,075	.....	40,000	.....
Dauphin,	670	.....	770,000	200,000	1,365,000	325	.....	53	53	163,800	134,440	.....
Delaware,	30	.....	.....	.....	325,000	.....	.....	.....	666	.....	.....	.....
Elk,	9,808	500	756,000	133,362,000	6,225,000	58,195	44,800	8,490	63,290	266,734	.....	.....
Erie,	350	240	100,000	1,321,000	2,010,000	398	.....	.....	720	.....	.....	.....
Fayette,	3,575	78	.....	40,000	12,609,544	50	.....	4,700	4,714	4,619,960	.....	.....
Forest,	6,070	95	13,425,507	64,257,960	12,661,001	30,745	1,000	13,300	21,390	1,911,000	.....	.....
Franklin,	494	92	250,000	.....	1,370,000	200	.....	.....	5,925	.....	.....	.....
Fulton,	1,581	159	1,125,000	65,000	1,503,000	475	.....	.....	2,970	.....	.....	.....
Greene,	118	30	.....	.....	1,000,000	50	.....	.....	.....	10,920	.....	.....
Huntingdon,	6,562	135	4,618,000	435,000	7,953,000	1,263	368	2,312	5,208	169,260	1,504,920	.....
Indiana,	1,925	110	330,000	2,367,000	7,357,190	915	45	.....	45	255,700	82,688	.....
Jefferson,	628	130	697,700	733,200	2,366,500	80	280	.....	290	279,480	.....	.....

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TABULATED STATEMENT OF TIMBER CUT IN PENNSYLVANIA IN 1906—Continued.

Counties.	Number of acres cut over.	Number of acres cut over to be used for farming purposes.	Number of feet (board measure) white pine cut.	Number of feet (board measure) hemlock cut.	Number of feet (board measure) other woods cut.	Number of cords of bark peeled.	Number of cords of pulp wood cut.	Number of cords used in the manufacture of alcohol or acid.	Total number of cords of cord wood cut.	Number of feet (board measure) cut for mine props.	Number of feet (board measure) cut for railroad ties.	Number of feet (board measure) cut for telegraph poles.
Juniata,	1,975	.....	1,400,000	425,000	4,950,000	357	.....	36	2,036	.....	.....	.....
Lackawanna,	95	.....	.....	.....	350,000	.....	.....	.....	.....	2,184,000	.....	.....
Lancaster,	623	10	5,000	.....	1,825,903	75	.....	.....	3,002	.....	.....	1,002,500
Lawrence,	225	103	.....	.....	2,470,000	.....	.....	.....	25	.....	.....	.....
Lebanon,	357	6	250,684	132,500	1,017,874	42	.....	.....	4,081	1,430,520	46,509	.....
Lehigh,	144	31	30,000	.....	760,127	159	.....	.....	910	.....	157,438	.....
Luzerne,	3,228	.....	652,000	6,332,000	7,402,062	3,540	.....	.....	1,570	5,486,670	.....	.....
Lycoming,	5,832	232	2,637,285	21,300,596	6,714,697	23,181	102	.....	7,793	1,463,700	462,000	17,100
McKean,	4,520	30	.....	825,000	1,178,000	265	36,500	15,754	52,598	.....	.....	.....
Mercer,	845	130	110,000	397,000	5,820,000	75	.....	.....	150	239,800	.....	.....
Mifflin,	1,475	.....	150,000	125,000	135,000	.....	125	565	1,190	333,060	.....	.....
Monroe,	2,473	7	638,500	150,000	938,606	335	290	.....	850	9,007,460	955,000	.....
Montgomery,	20	18	.....	.....	106,000	.....	.....	.....	343	.....	.....	.....
Montour,	138	.....	50,000	.....	200,000	.....	.....	.....	.....	.....	.....	.....
Northumberland,	287	20	43,000	.....	60,000	253	.....	.....	72	749,020	12,000	.....
Northampton,	515	87	317,000	62,000	2,315,210	172	310	.....	5,395	21,600	202,400	.....
Perry,	1,121	95	1,142,000	175,000	2,553,400	446	100	8,179	8,554	.....	.....	5,000
Philadelphia,	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pike,	1,195	115	1,306,202	486,890	2,430,014	191	20	.....	327	1,828,100	738,000	.....
Potter,	21,046	463	1,223,000	207,509,902	52,800,000	109,892	79,100	4,809	91,166	.....	.....	.....
Schuylkill,	645	36	823,400	254,815	481,730	217	.....	.....	2,709	3,884,248	19,679	.....
Snyder,	704	.....	1,035,000	197,000	1,378,000	1,346	.....	642	745	16,380	182,000	.....
Somerset,	3,556	287	490,000	5,260,000	19,280,266	1,518	1,500	4,000	5,525	3,456,180	.....	.....
Sullivan,	4,454	354	126,500	24,793,700	24,159,500	16,078	.....	4,001	5,273	202,020	.....	.....
Susquehanna,	878	228	372,356	2,551,719	1,633,090	2,015	.....	3,188	3,563	1,024,640	.....	.....
Tioga,	2,606	100	1,836,037	27,226,100	17,529,200	12,759	3,260	.....	4,867	136,354	.....	.....
Union,	1,667	15	1,726,380	1,503,694	1,904,026	1,080	143	.....	643	2,753,370	330,000	.....
Venango,	6,088	70	910,000	873,000	6,121,000	430	.....	.....	175	5,091,360	888,800	62,500
Warren,	4,439	530	3,244,364	12,403,017	10,283,533	5,216	10,000	900	12,000	.....	220,000	.....
Washington,	697	441	.....	.....	8,907,765	20	.....	.....	2,000	340,500	.....	.....
Wayne,	1,514	108	426,726	3,494,190	5,144,632	1,543	.....	7,850	9,127	3,085,880	1,736,600	.....

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Westmoreland,	2,479	57	.....	1,650,000	8,982,800	500	.....	45	.....	45	2,705,760	27,200	.....	.....	.....	.....	.....	.....
Wyoming,	987	75	840,000	5,773,000	2,425,000	3,539	.....	.....	3,000	5,500	1,981,160	300,000	.....	.....	.....	.....	.....	.....
York,	794	22	60,000	65,000	2,994,722	516	.....	.....	.....	2,839	.....	686,392	97,600	.....	.....	.....	.....	.....
	158,066	10,161	72,281,287	682,696,952	376,461,836	354,287	204,021	97,060	426,343	74,484,392	10,161,022	2,572,100						

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TABULATED STATEMENT OF TIMBER CUT IN PENNSYLVANIA IN 1907.

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Adams,	557	89	277,000	57,000	1,765,000	3,078	.....	.....	1,023	.....	.....	.....
Allegheny,	304	64	25,000	30,000	1,950 000	.....	.....	.....	760	.....	.....	.....
Armstrong,	430	150	50,000	100,000	1,124,765	.....	.....	.....	.....	.....	.....	.....
Beaver,	35	25	.....	.....	600,000	.....	.....	.....	.....	.....	.....	.....
Bedford,	4,695	325	1,456,000	1,733,000	12,916,270	3,478	506	4,197	6,973	1,674,910	518,000	300,000
Berks,	111	13	81,000	5,000	481,878	10	.....	.....	1,380	60,060	4,796	.....
Blair,	1,331	230	256,000	235,000	2,224,629	120	9,02;	1,364	10,888	1,580,270	616,250	.....
Bradford,	3,607	65	1,245,866	43,149,678	1,712,067	23,392	12,000	8,584	20,869	382,200	120,000	.....
Bucks,	114	9	.....	.....	835,000	29	.....	.....	1,476	.....	.....	.....
Butler,	360	25	.....	.....	3,439,587	.....	.....	.....	.....	.....	.....	.....
Cambria,	4,494	213	569,000	6,276,826	10,988,260	1,393	122	.....	150	1,956,940	652,600	.....
Cameron,	4,304	.....	704,457	101,884,907	6,117,248	63,591	42,434	321	42,755	.....	.....	.....
Carbon,	432	.....	442,000	37,333	126,500	.....	.....	.....	94	513,240	59,575	.....
Centre,	3,571	329	3,474,890	531,000	12,642,135	1,465	761	6,549	9,604	5,356,260	1,141,000	5,000
Chester,	491	28	.....	.....	1,797,000	.....	1,065	.....	8,280	.....	.....	165,000
Clarion,	711	83	878,646	447,000	2,776,152	126	.....	.....	.....	125,000	.....	.....
Clearfield,	10,131	131	3,265,560	9,758,050	11,988,671	5,149	7,357	288	7,696	3,063,080	18,700	.....
Clinton,	5,302	75	4,035,194	12,483,541	5,466,519	1,283	2,407	.....	2,407	3,905,620	1,051,200	.....
Columbia,	558	40	635,000	675,000	2,367,296	140	.....	.....	.....	174,720	.....	.....
Crawford,	608	160	414,007	1,838,579	3,677,701	847	.....	.....	1,523	.....	.....	.....
Cumberland,	96	11	17,000	.....	690,000	6	.....	.....	585	.....	.....	.....
Dauphin,	524	.....	143,475	115,509	2,548,795	114	.....	629	1,109	589,680	184,460	.....
Delaware,	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Elk,	13,282	335	1,439,112	299,353,012	18,678,394	103,040	28,275	22,304	50,579	661,660	.....	.....
Erie,	345	175	90,000	606,666	2,312,500	108	.....	.....	333	.....	.....	.....
Fayette,	1,972	47	.....	1,372	10,109,618	2	.....	.....	.....	2,151,060	.....	.....
Forest,	4,382	10	9,441,834	67,933,164	15,793,148	43,255	3,765	5,015	8,800	859,500	3,520,000	45,000
Franklin,	267	50	76,000	.....	1,135,000	480	210	.....	1,870	.....	.....	975,000
Fulton,	661	65	547,000	.....	2,091,000	493	.....	.....	908	.....	110,000	.....
Greene,	100	18	.....	.....	726,840	.....	.....	.....	35	18,000	.....	.....
Huntingdon,	5,744	51	5,490,125	326,101	13,137,936	892	225	1,097	1,572	687,960	352,660	.....
Indiana,	2,976	425	241,000	3,596,100	14,591,903	175	.....	.....	.....	1,010,000	.....	.....
Jefferson,	235	57	1,010,000	489,000	1,608,500	60	.....	.....	6	356,600	27,420	.....

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Juniata,	1,370	.....	435,000	52,000	3,135,000	71	.....	996	1,796	.....	66,000	.....	.....	.....	.....
Lackawanna,	185	.....	.....	250,000	350,000	50	.....	.....	.....	157,329	.....	.....	.....	.....	.....
Lancaster,	420	9	.....	.....	2,531,971	26	.....	.....	3,170	.....	607,200	.....	.....	.....	.....
Lawrence,	280	97	.....	.....	3,256,000	.....	.....	.....	300	32,700	200,000	.....	.....	.....	.....
Lebanon,	321	21	500	1,040	318,126	.....	.....	.....	2,268	1,102,920	414,340	.....	.....	.....	.....
Lehigh,	153	10	34,000	.....	1,139,632	118	.....	.....	770	317,680	45,848	.....	.....	.....	.....
Luzerne,	8,904	.....	708,376	4,979,165	7,864,148	2,193	.....	.....	50	5,213,100	355,200	.....	.....	.....	.....
Lycoming,	4,156	95	1,029,666	51,259,333	3,953,166	48,298	2,200	1,814	4,154	1,262,100	.....	.....	.....	.....	.....
McKean,	1,715	25	.....	1,685,000	2,950,000	410	11,000	12,063	26,579	.....	.....	.....	.....	.....	.....
Mercer,	503	20	25,000	60,000	2,716,000	.....	.....	.....	200	305,760	.....	.....	.....	.....	.....
Mifflin,	57	.....	.....	.....	25,000	20	.....	736	806	109,200	.....	.....	.....	.....	.....
Monroe,	1,354	115	480,000	87,000	717,500	215	439	10	3,947	3,161,300	1,028,000	77,000	.....	.....	.....
Montgomery,	20	13	.....	.....	149,000	.....	.....	.....	490	.....	22,000	.....	.....	.....	.....
Montour,	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Northumberland,	196	.....	225,000	50,000	525,000	435	.....	27	27	1,010,000	.....	.....	.....	.....	.....
Northampton,	189	3	248,000	57,000	1,273,000	118	.....	.....	1,635	.....	300,960	.....	.....	.....	.....
Perry,	1,223	.....	1,260,000	130,000	1,995,000	521	.....	6,978	7,078	.....	.....	.....	.....	.....	.....
Philadelphia,	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....
Pike,	2,349	52	2,075,737	614,000	1,865,000	20	.....	.....	448	1,592,300	78,460	.....	.....	.....	.....
Potter,	27,585	262	7,605,368	377,955,518	58,748,066	262,215	124,635	9,831	134,952	.....	.....	.....	.....	.....	.....
Schuylkill,	506	115	691,269	354,253	646,526	201	.....	.....	1,672	2,814,990	1,314,798	.....	.....	.....	.....
Snyder,	573	4	768,630	97,025	1,674,474	306	.....	794	1,274	823,920	.....	.....	.....	.....	.....
Somerset,	6 481	77	15,020,000	30,936,000	29,568,591	15,148	.....	.....	.....	2,324,240	8,800	.....	.....	.....	.....
Sullivan,	4,592	53	366,000	37,882,000	18,295,000	18,614	.....	22,515	22,835	260,860	.....	.....	.....	.....	.....
Susquehanna,	1,193	93	560,000	2,806,107	3,428,879	998	.....	5,099	7,169	3,227,890	.....	.....	.....	.....	.....
Tioga,	2,880	400	1,827,167	33,505,388	4,611,114	16,060	2,696	388	12,289	141,534	.....	.....	.....	.....	.....
Union,	2,337	207	3,089,001	1,691,658	2,135,867	1,334	130	75	384	4,144,140	271,000	.....	.....	.....	.....
Venango,	1,425	19	867,000	432,000	3,169,000	85	.....	.....	70	253,400	1,902,800	.....	.....	.....	.....
Warren,	3,680	250	7,871,000	33,020,666	6,990,000	25,567	3,000	4,604	13,623	.....	361,196	.....	.....	.....	.....
Washington,	638	436	.....	.....	6,901,503	.....	.....	50	50	348,540	.....	.....	.....	.....	.....
Wayne,	2,073	171	1,239,495	2,860,000	8,022,000	1,309	.....	23,072	24,127	2,693,215	80,000	8,800	.....	.....	.....
Westmoreland,	1,672	145	.....	1,062,000	10,027,947	38	.....	.....	60	2,131,020	.....	.....	.....	.....	.....
Wyoming,	1,064	22	1,120,000	11,235,000	5,960,000	4,840	5,317	4,804	11,611	410,740	764,860	.....	.....	.....	.....
York,	438	9	36,600	33,000	1,778,371	107	.....	.....	3,021	.....	126,200	.....	.....	.....	.....
	154,171	6,070	83,887,965	1,144,216,791	385,293,193	652,020	263,097	144,284	468,430	58,371,603	16,352,323	1,675,900			

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TABULATED STATEMENT, BY COUNTIES, OF LOSSES FROM FOREST FIRES, FOR THE YEAR 1906.

Counties.	Number of acres burned over.	Number of feet (board measure) of logs burned.	Number of feet (board measure) of sawed lumber burned.	Number of railroad ties burned.	Number of mine props burned.	Number of cords of pulp wood burned.	Number of cords of cord wood burned.	Number of cords of bark burned.	Panels of fence burned.	Number of buildings burned.	Value of buildings burned.	Cost to individuals to extinguish fires.	Number of men employed.	Number of days employed.	Total money value of all kinds of property destroyed.
Bedford,	2,759	23,000	1,000	200	.....	205	45	7	1,035	1	.....	$133 46	165	15¾	$5,140 00
Bradford,	380	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,370 95	100	11	2,250 00
Blair,	3,216	.....	.....	.....	300	.....	15	.....	88	1	$400 00	369 50	109	4¾	3,525 00
Butler,	5	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	40 00
Cambria,	5,249	.....	.....	500	5,000	200	4	.....	170	.....	.....	118 75	58	14	1,720 00
Cameron,	1,080	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,070 00
Carbon,	1,713	.....	.....	.....	.....	.....	.....	.....	125	.....	.....	90 50	72	13	1,175 00
Centre,	5,270	.....	.....	1,575	1,700	5	.....	.....	60	.....	.....	85 00	55	9½	4,325 00
Chester,	103	.....	.....	.....	.....	.....	19	.....	495	.....	.....	9 00	13	2	505 00
Clarion,	590	.....	3,000	.....	.....	.....	.....	.....	625	.....	.....	45 75	32	4	1,670 00
Clearfield,	3,643	427,050	.....	400	1,800	.....	.....	.....	490	.....	.....	208 35	120	13	6,870 00
Clinton,	2,410	54,000	2,000	.....	5,000	30	217	15	216	1	52 00	363 90	115	14½	5,540 00
Columbia,	810	.....	.....	1,200	.....	.....	.....	.....	861	.....	.....	81 00	19	15½	1,965 00
Cumberland,	57	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	8 40	3	4	65 00
Dauphin,	25	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	25 00
Elk,	2,166	207,500	.....	.....	.....	1,123	.....	.....	.....	5	500 00	155 10	50	2½	3,000 00
Fayette,	275	30,000	30,000	150	2,000	.....	.....	.....	400	.....	.....	19 50	8	2½	850 00
Forest,	2,241	207,500	.....	.....	.....	1,124	.....	.....	40	.....	.....	155 10	50	2½	4,020 00
Franklin,	207	.....	.....	.....	.....	.....	400	10	180	.....	.....	1 25	1	1	950 00
Fulton,	2,395	4,000	.....	.....	.....	300	40	25	650	.....	.....	60 00	61	4½	2,300 00
Huntingdon,	186	.....	.....	.....	.....	250	.....	.....	50	.....	.....	8 50	3	4	475 00
Indiana,	25	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	35 00	20	2½	200 00
Jefferson,	296	2,000	.....	525	8,500	.....	50	.....	275	.....	.....	92 70	42	15	1,620 00
Juniata,	65	.....	.....	.....	.....	.....	.....	.....	100	.....	.....	.....	.....	.....	150 00
Lehigh,	10	2,000	.....	.....	.....	.....	30	.....	.....	.....	.....	.....	.....	.....	140 00
Luzerne,	1,752	.....	.....	.....	.....	.....	.....	20	240	.....	.....	307 00	145	11	2,450 00
Lycoming,	122	.....	.....	.....	.....	.....	.....	.....	20	.....	.....	1,390 40	128	11	330 00
Mifflin,	140	.....	.....	.....	.....	.....	.....	.....	260	1	1,250 00	.....	.....	.....	1,720 00
Monroe,	1,110	.....	.....	50	4,000	.....	.....	.....	486	.....	.....	155 00	50	17½	3,050 00
Montour,	210	.....	.....	.....	.....	.....	.....	.....	50	.....	.....	4 00	2	1	450 00
Northampton,	22	.....	.....	.....	.....	.....	20	.....	50	.....	.....	4 00	3	1	210 00
Northumberland,	8	.....	.....	.....	200	.....	.....	.....	80	.....	.....	10 50	6	1	100 00
Perry,	1,172	.....	.....	.....	.....	.....	5	.....	135	.....	.....	61 10	26	10	2,070 00

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Pike,	420	.....	.....	.....	.....	.....	.....	.....	100	.....	.....	19 50	16	1½	680 00
Potter,	200	400,000	.....	.....	.....	.....	.....	.....	.....	.....	.....	1,876 59	100	15	2,500 00
Schuylkill,	2,054	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	85 00	18	40½	750 00
Snyder,	4	.....	.....	.....	.....	.....	.....	.....	25	.....	.....	7 50	3	2	20 00
Somerset,	1,127	3,000	.....	300	1,500	.....	.....	.....	470	.....	.....	203 00	44	13½	3,300 00
Sullivan,	70	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	96 80	10	8	250 00
Susquehanna,	150	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	40 00	10	3	200 00
Tioga,	103	.....	.....	.....	.....	.....	.....	.....	115	.....	.....	458 29	61	8	225 00
Venango,	310	25,000	.....	100	2,500	.....	.....	.....	50	.....	.....	44 00	27	2	1,125 00
Warren,	200	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	400 00
Wayne,	22	.....	.....	.....	.....	.....	.....	.....	50	.....	.....	9 00	6	1	100 00
Westmoreland,	40	.....	.....	.....	.....	.....	.....	.....	40	.....	.....	15 00	12	1	75 00
Wyoming,	6	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	5 00	4	1	40 00
York,	67	1,000	1,500	1,150	.....	20	10	.....	140	1	15 00	2 00	2	½	435 00
	44,495	1,386,050	37,500	6,150	32,500	3,257	855	77	8,701	10	$2,217 00	$8,205 39	1,769	305	$70,070 60

WHAT CAUSED FOREST FIRES DURING 1906.

Unknown,	80
Railroads,	70
Carelessness,	43
Incendiary,	36
Hunters and fishermen,	35
Saw mills,	7
Boys,	5
Tramps,	4
Berry pickers,	3
Dinkeys and log trains,	2
	275

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TABULATED STATEMENT, BY COUNTIES, OF LOSSES FROM FOREST FIRES, FOR THE YEAR 1907.

Counties.	Number of acres burned over.	Number of feet (board measure) of logs burned.	Number of feet (board measure) of sawed lumber burned.	Number of railroad ties burned.	Number of mine props burned.	Number of cords of pulp wood burned.	Number of cords of cord wood burned.	Number of cords of bark burned.	Number of panels of fence burned.	Number of buildings burned.	Value of buildings burned.	Cost to individuals to extinguish fires.	Number of men employed by individuals.	Number of days employed.	Total loss by reason of forest fires.
Armstrong,	65														$150 00
Berks,	45								85						60 00
Bradford,	660	2,000					1,004		794			$1,319 49	136	24½	3,458 00
Bucks,	95						5		62						650 00
Butler,	120			100					25			90 00	2	3	180 00
Cambria,	8								40			3 25	5	½	15 00
Centre,	571						10		150	2	$500 00	14 00	11	2	1,675 00
Chester,	8								10						50 00
Clarion,	95								100			7 00	13	1	290 00
Clearfield,	1,167	8,000		125		160	1,052	1,625	30			4,468 00	255	5½	7,450 00
Clinton,	163						15		500			20 00	1	20	435 00
Columbia,	2,082								30			94 00	56	2	4,915 00
Cumberland,	3,179			3,000			60		30			153 00	77	6½	5,122 00
Dauphin,	56			100											290 00
Delaware,	3														15 00
Elk,	35														130 00
Forest,	188	4,000			200	40	1		200			140 50	30	9	775 00
Franklin,	170						9					1 50	1	1	450 00
Fulton,	55								100			52 00	23	2½	225 00
Huntingdon,	194	7,000		25	1,000	30	30		125			178 00	95	3½	810 00
Jefferson,	621			50								12 50	4	4	1,530 00
Lackawanna,	332					25	50		55			35 00	21	6	450 00
Lancaster,	31		2,000												320 00
Lebanon,	50						30		20			2 50	2	½	200 00
Lehigh,	14														58 00
Luzerne,	1,345											204 64	54	43½	1,880 00
Lycoming,	659	85,000						200	20			3,015 00	112	4	5,350 00
Monroe,	295								50			89 25	59	7½	950 00
Montour,	5											5 00	4	1	40 00
Northumberland,	68											6 25	5	1	225 00
Perry,	61								27			23 75	16	4	325 00
Pike,	200											12 00	5	1½	400 00
Potter,	1,550	85,000						1,013				5,306 96	305	20	9,476 00

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Schuylkill,	457	2,000	.....	.....	.....	.....	.....	.....	53	.....	.....	183 40	35	48½	2,030 00
Susquehanna,	39	.....	.....	.....	.....	.....	.....	.....	10	.....	.....	15 00	2	4	205 00
Tioga,	1,040	335,000	.....	.....	.....	.....	.....	2,713	.....	.....	.....	7,477 00	300	12	14,400 00
Venango,	3,597	2,000	.....	5,375	1,000	.....	.....	.....	260	.....	.....	1,690 00	238	12	7,350 00
Warren,	40	.....	.....	.....	.....	160	.....	47	.....	.....	.....	579 00	50	4	1,000 00
Wayne,	25	.....	.....	.....	.....	.....	200	.....	.....	.....	.....	25 00	13	1	250 00
York,	1	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	.....	50 00
	19,389	530,000	2,000	8,775	2,200	415	2,466	5,598	2,776	2	$500 00	$25,222 99	1,930	256½	$73,623 00

CAUSES OF FOREST FIRES DURING 1907.

Railroads,	69
Incendiary,	11
Burning brush,	19
Hunters and fishermen,	5
Saw mills,	4
Carelessness,	3
Dinkey engines,	2
Unknown,	52
Total,	**165**

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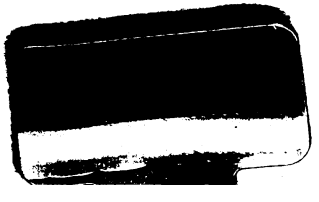

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